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EXCURSIONS.

Dec. 15.—Outer Harbor. Train, 1.35 p.m. Dredging. Leaders, Prof. T. Harvey Johnston and Mr. H. M. Hale.

1929.

Feb. 16.—Outer Harbor. Train, 1.35 p.m. Dredging. Leaders—Messrs. W. J. Kimber and E. C. Cole.

The
South Australian Naturalist.

Vol. X. NOVEMBER, 1928. No. 1.

THE ORIGINAL FLORA OF THE ADELAIDE PLAINS

PART I.

By J. B. Cleland, M.D.

The native plants still to be found in the neighbourhood of Adelaide have not escaped the notice of recent botanists. Mr. J. M. Black, in an early number of this journal (Vol. I, No. 3, 1918), under the title of "The Primitive Flora of Adelaide", noted 27 species at that date. Later Mr. E. H. Ising, under the heading "List of Native Plants growing in the Railway Reserve at Mile End" (Vol. V., No. 2, Feb. 1924), added 13 more and supplemented this in November of the same year (Vol. VI., No. 1) with 6 further species, bringing the total to 46. In the present communication (Part I) a few general observations will be made with indications of where some species of native plants may still be found and this will be followed by two lengthy excerpts descriptive of the botanical features of the area in the early days of the Province. In the second part, a more systematic attempt will be made to record where native plants may still be found, supplementing the information already known.

The original flora has disappeared for the most part over the area bounded on the one hand by the Gulf from Brighton to Outer Harbour and on the other by the foothills of the Mt. Lofty Range. On the fertile plains cultivation first destroyed the orinal plants and now houses are replacing the fields of corn, orchards and vineyards. The primeval flora remains almost undisturbed only in and behind the sandhills by the coast, on the salt-marshes and along the estuarine creeks with their paperbark tea-tree and mangroves. More or less extensive relics are to be seen in the Reedbeds, in the Pinery on the eastern side of the Port River between Alberton and the Grange, in a small area of scrub with mallee near Enfield, in private properties abutting the foothills and slightly along the River Torrens and the Torrens Lake. A few Red Gums (*Eucalyptus rostrata*) still re-

main near watercourses as at the Reedbeds, at Fullarton and Burnside. Some Peppermint Gums (*E. odorata*) still survive at the Black Forest, Fullarton and Beaumont and occasional Yellow Gums (*E. leucoxylon*) at the latter place. Wallaby Grass (*Danthonia penicillata*) may be found in the newer eastern suburbs. Two species of *Stipa*, Kangaroo Grass, *Lomandra glauca* and *Acacia obliqua* occur on Beaumont Common. *Vittadinia australis* (in two forms) and *Oxalis corniculata* are still met with in fields near Beaumont

On the footpath of Fullarton road, beside the galvanized fence of the Fullarton laundry, is still to be seen a small patch of the sedge, *Cyperus vaginatus*. From this we can reconstruct to some extent the appearance of this spot when Adelaide was founded. The sedge shows that there is still some moisture present Evidently originally it was semi-swampy, probably with some tea-tree (*Leptospermum*) beside the shallow water. In the southern part of Knoxville there still remains a small area which becomes boggy in wet weather. Draining from this, till recently, was a watercourse that had become very deep from erosion into the clay soil. As shown by some saline incrustation, the water contains salts of some kind which account for the rather bare aspect around. Being useless for building purposes this area has been made into a reserve. *Triglochin striata* is still found growing here as well as the common *Spergularia rubra*. The grass *Glyceria stricta* is also quite abundant. There is a small area of swampy soil from a spring just north of St. Saviour's Church, at Glen Osmond. *Cyperus vaginatus* flourished here till recently trampled out. The soil below this, west of the Portrush road, as shown by recent sewerage excavations, is black and peaty-looking through several feet of thickness. Water from a spring finds its way into the gutter on the north-east side of the Glen Osmond road. This year, bulrushes (*Typha angustifolia*) came up in the gutter. The sweet-scented liliaceous *Dichopogon* was common thirty years ago in the Park Lands near the Adelaide Race-course, but seems to have disappeared. *Boerhavia diffusa* has turned up in a garden at Beaumont, probably a rare example of a native plant becoming a weed and extending its habitat Doubtless a few further examples of survivors, apart from the localities already specially mentioned, will be found on searching but they must be few.

What records exist as to the plant covering of the extensive plains between the Reedbeds and the Mt. Lofty Range when Adelaide was chosen as the site of the capital city? Were the plains chiefly grassy or shrubby, heavily timbered or lightly cov-

ered with trees or with trees only near water-courses? It is difficult to find any full description but we catch a glimpse in James Backhouse's "A Narrative of a Visit to the Australian Colonies" (1843). Backhouse was a Quaker, a keen and accurate observer and a good botanist. He landed at Glenelg on November 28th, 1837, when the Province was not yet a year old. In a light chaise cart he drove with his captain to Adelaide "over a flat country, covered with grass, and scattered trees of *Eucalyptus*, *Acacia* and *Banksia*" and received a kind welcome from John Barton Hack and his wife. On November 30th, he walked seven miles to Port Adelaide. "The way was over two level plains, separated by a slight sandy rise, covered with wood. The soil of the plains was a reddish loam, having a slight admixture of sand and calcareous matter. They were covered with tufted grass and small herbs. Among the latter was a species of *Eryngium*, a foot high, the leaves of which are eaten with avidity by cattle, and some small, yellow-flowered Everlastings (*Helichrysum apiculatum?*). Near Port Adelaide, the land becomes saline, and produces crimson *Mesembrianthemum*, of three species (only two species, *M. aequilaterale* and *M. australe*, have been recorded as indigenous in South Australia—what was the third? Perhaps a more succulent form of the last named), along with numerous maritime shrubs. On a sandbank separating the plain from the salt marsh, which borders the creek or inlet that forms the harbour, there are trees of a species of *Callitris*, resembling Cypress. These are here called Pines, and have trunks 40 feet high, which are used for piles. *Casuarina quadrivalvis* (*C. stricta* now), and *Banksia australis* (i.e. *B. marginata*), likewise grow here. On this bank there was an *Orobanche*, very like *Orobanche minor* of England. . . . . The salt marsh was covered with two species of *Salicornia*, one of which was shrubby; interspersed among these, were two species of *Frankenia*, one of which was bushy, about a foot high, and besprinkled with rosy, pink blossoms, the size of a silver penny. (Only *F. pauciflora* is now known from this locality. Was there another species?). The creek was margined with Mangrove, *Avicennia tomentosa* (*A. officinalis*)."

On December 1st, Backhouse visited the Torrens, a stream about a foot deep and four feet wide, though with numerous pools in its course. "In some places there are reedy flats below the banks of the river, which are of red loam, and are ornamented by a variety of shrubs and flowers; among which are *Lavatera plebeja*, *Verbena officinalis* and two species of *Goodenia* (one would be *G. ovata*).

The same day, he walked a few miles towards the Mt. Lofty Range "on a plain which is several miles wide and extends from Cape Jarvis (*sic*) to the head of St. Vincent's Gulf. It is covered with grass, and intersected with belts of Gum-trees, and a sickle-leaved *Acacia* (probably *A. pycnantha*). Some of the Kangaroo-grass was up to our elbows, and resembled two years' seed meadows, in England, in thickness; in many places, three tons of hay per acre, might be mown off it. I had not seen anything to equal it, in this part of the world, except in some of the places that had not been browzed (*sic*), about Wellington Valley. Several small groups of honest-looking, English labourers were mowing; but their work was only to be seen as little patches, on coming upon them." On this walk Backhouse probably reached somewhere about the position of the present Portrush Road at Toorak or Knoxville. Contrast the growth of Kangaroo-grass (*Themeda triandra*) that he saw with the houses now occupying this area, preceded by fields of corn and dairy pastures.

On December 6th, Backhouse walked with two of J. B. Hack's sons to a place called The Pines, about five miles from Adelaide. I think there is little doubt, fom the plants he noted there and the distance, that this is the place just beyond Enfield visited in 1927 by the Field Naturalists' Section. The plants he records are all still to be found, even to the "Gum-tree of low growth with yellowish-white blossoms" which aptly describes the mallee, *Eucalyptus oleosa*. Moreover, I know of no other likely situation that could be suggested as an alternative in which these plants might have been. To continue with Backhouse's description: "This is a sandy tract, of limited extent and slight elevation, differing considerably in its vegetation from the general features of this district. Among the trees, is the species of *Callitris*, here called Pine: the timber it affords is said soon to decay: the tree is of pyramidal figure, and seems distinct from any we have before seen. We also met with a Gum-tree of low growth, with yellowish-white blossoms (evidently *Eucalyptus oleosa*), an *Exocarpus* (*E. spartea* is found at Enfield), a *Myoporum* (*M. deserti* is still there), a *Cassia*, and several other trees and shrubs that were new to us."

On December 12th "we visited a sawyer's station, among the hills, in the direction of Mount Lofty. After crossing the grassy plains of Adelaide, the first hills, which are nearly at a right-angle with the Mount Lofty range, are of limestone, with here and there, argillaceous rocks. These hills are grassy, with a

few trees, and a variety of plants. The next hills are more purely argillaceous, and have trees scattered upon them, like the last, they run rather steeply, into valleys, which are well sheltered, and some of them have small streams at the bottom. Adjoining, there are slate hills, which have less abundant vegetation, and more scrub. The next hills are of old red-sandstone, with poor, sandy soil, but abounding in gay, vegetable productions, in forest, of various species of *Eucalyptus;* among these is the useful Stringy-bark, which some parties are sawing for boards and splitting for fencing. The carriage from this place to Adelaide is easy, being all the way downhill. Beyond this point, the mountain range exhibits white quartz; and persons who have passed Mount Lofty, which may be 1,500 to 2,000 feet above the level of the sea, say that between it and Mount Barker, the country is fine and woody, and that it also looks well toward Lake Alexandrina. On returning, we descended into a deep valley, at the junction of one of the slate hills, with one of the argillaceous ones, of less slaty character, and found a waterfall of about 160 feet, on a stream, called the White Hill Creek. (This must be the Waterfall Gully). Some of the hills, like the plains below, are covered with red loam, in which there is fine Kangaroo-grass (all now gone), that is green, notwithstanding the thermometer has, several times lately, risen to 107° in the shade.

"A white-flowered *Morna* (I cannot suggest what this was) a downy, drooping flowered *Pimelea* (probably *P. octophylla*), a broad and a narrow-leaved *Xanthorrhoea* (*X. semiplana* and *X. quadrangulata*), and several other striking plants, were growing in the forest on the red sandstone. On the argillaceous hills, there was a shrub belonging (to) the *Gentianae*, with leaves resembling those of the Greater Periwinkle (possibly *Logania vaginalis*), and a *Pomaderris* (*Stylidium parvifolium*, probably), with pale leaves next to the heads of flowers. *Todea africana* (*T. barbara*), *Grammitis rutaefolius* (*Pleurosorus rutifolius*), and some other ferns were also here. Upon the limestone hills, were a broad-leaved *Goodenia* (*G. albiflora* still grows on this limestone), an *Orobanche*, and *Lobelia gibbosa*, this last is a singular annual, flowering after its leaves have faded."

Another glimpse of the covering of the Adelaide plains may be gained from J. W. Bull's, "Early Experiences of Colonial Life in South Australia" which, though published in 1878, describes events in the early days, the author having arrived in the second year after the proclamation of the province. It appears there was

a considerable amount of cattle-stealing not many years after the foundation of Adelaide, and Sergeant-Major Alford and another officer were detailed to make a thorough search disguised as bushmen. After visiting the gullies north of Adelaide and going south as far as the Sturt River and finding nothing, the Sergeant-Major decided to make a cast of the plains round Adelaide. On passing Dr. Everard near his home at the Black Forest, Alford was told that cattle had been seen being driven down the Forest track. Bull here mentions that, at the time he wrote (about 1878) on the opposite side of the road to the Ashford Estate there were still a number of trees (of *Eucalyptus odorata* chiefly), formerly part of the Black Forest, which, with the exception of this patch, has vanished, and they are now the only remains of that ancient and dense wood which extended from South-terrace towards Holdfast Bay, in many places having a thick undergrowth of scrub. The Sergeant-Major at this time decided to make a search and proceeding down a slight track for a mile and a half came to a fallen tree across the track. Creeping through the thick bush for a mile or so, he came suddenly on a stockyard with cattle and men. Pretending to have observed nothing and to be searching for cattle, Alford gradually retreated and finally rode away for help. He returned with one man late in the night to make a further inspection but their presence being detected by the men who were at work and who could be heard steeling their knives, the two had to make an assault and captured one man, the other three escaping. It will be evident from this account what a thick forest of peppermint gums and undergrowth must have existed then to enable this "cattle-duffing" to be carried on for so long in a place so near the infant capital. The meat thus obtained was apparently sold to ships in port. Alas, hardly a vestige now remains of these old trees.

F.N.S. LIBRARY.

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SOUTH AUSTRALIAN SHELL COLLECTORS' CLUB.

The following shell families, among others, were recently studied by this Club, and quite a large number of specimens were exhibited at various meetings:—

Family *LATERNULIDAE.*

Geological records state that shells (*Anatinidae*) belonging to this Family attained thereir maximum development in the Jurassic period, and, of the many genera living in that age, only a few survived to the present day. Casual observation soon determines that these bivalves are to be placed in different category from those usually met with. Their thin, translucent, white valves gape widely at one end, allowing the siphons free exit. These brown tubes—which cannot be completely withdrawn into the shell—are 1½ inches in length, eject a stream of water on being disturbed. A small cartilage socket is situated immediately under the beaks, supported by an oblique rib. Another distinctive feature is the right-angled groove or fissure extending from the beaks.

Laternula creccina, Reeve, is plentiful in the Port Adelaide River, at a point known as Snowdon Beach. Low tide discloses only a few loose dead valves lying about, but, on removing a layer of sand and mud, large numbers of living specimens may be collected. The siphons, which are partly clothed with an extension of the periostracum, reach to the surface of the mud. When cleaned, these delicately fashioned pearly shells, taken from such an uninviting habitat, present somewhat of a contrast to the usual order of things.

Cochlodesma angasi, Crosse and Fischer, another member of the Family, is occasionally collected on eastern Yorke Peninsula beaches measuring up to 3 inches in length. The valves of this fine shell show concentric growth lines, and generally have most of the characteristics of the former specimen, excepting that the right valve is comparatively flat, while the left side decidely bulged.

Family *CRASSATELLITIDAE.*

Several *Crassatella* are recorded from South Australian waters, including a large specimen of particular note—*C. kingicola,* Lamarck (1801). A typical shell from Port Lincoln harbor shows it to measure roughly 4 inches in length, 3 inches deep, and 2 inches in width. As its name implies, it is heavy and solid, weighing 11½ ozs. This shell is considerably attenuated posteriorly—a line drawn through the umbo shows this to be as 3 to 1. The concentrically striated valves—characteristic of the family—

are covered with a thick brown periostracum, eroded at the umbo. The muscle scars are deeply pitted, the anterior oval shaped, and the posterior—¾ inch in diameter—rounded. These are joined by a simple pallial line. A deep cartilage pit exists in both valves. This shell occupies a premier position among local bivalves in point of size, excepting *Pinna* and *Ostrea*. Though chiefly taken from waters in the vicinity of Port Lincoln, it has been dredged from several other places. Old, worn valves are occasionally found at the Outer Harbor, showing at no distant date, this specimen was living at this place. An excellent description of *C kingicola* appears in Royal Soc. Trans. of S.A., Vol. 29. (Sir J. C. Verco).

Family *CHAMIDAE*.

These bivalves usually cement their lower valves firmly to some loose stone or ledge of rock, and limy encrustations soon give them an irregular, shapless appearance. Two solid teeth in the right convex valve are opposed by one in the left valve, which is comparatively small and flat. This method of attachment may be reversed, in which case the teeth are also interchangeable. The elongated muscle scars, which show up prominently on the white interior, are joined by a simple, non-sinuated pallial line. *Chama fibula*, Reeve, represents this family in our waters, and examples measuring two inches across have been collected in a perfect state on the beaches.

F. TRIGG,
Hon. Secretary, S.A. Shell Collectors' Club.

October, 1928.

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NATIVE FLOWER SHOW, OCTOBER 12 AND 13, 1928.

The official opening by the Lord Mayor (Mr. Lavington Bonython) took place on the Friday, the Lord Mayor being introduced by Mr. H. M. Hale, the Chairman of the Section.

The display was a very varied and beautiful one, though less in point of quantity than in some former shows. Members worked energetically to make the Show a success. Unfortunately space will not allow the publication of the long list of helpers.

One of the chief items was the pyramid exhibiting the massed flowers. The Schools display, the tables of named flowers, and the interstate displays (including as they did flowers from Western Australia, New South Wales and Victoria, with a special display from the Grampians) were especially attractive. Mr.

Burdett, of Basket Range, made a splendid display with flowers from his garden of native plants. These included Leschenaultias, Kangaroo Paws, Boronias and many other unique specimens of Australia's native flora. Mr. Edwin Ashby, of "Wittunga," Blackwood, showed a fine exhibit of cultivated native flowers. Fine native peaches, grown in Rose Park, were shown by Mr. W. Hill.

Flowers were also received from Queensland; each of the interstate exhibits were sent by the Field Naturalists' Clubs in the respective States.

Many other branches of natural history were well represented, insects from the Museum, minerals from the Department of Mines, the University, and from Mr. Thomas, birds shown by Captain White, Coastal Plants and Common Weeds shown by Mr. Lewis were on exhibition. Microscopic exhibits shown and explained by a band of enthusiasts under the direction of Mr. W. A. Harding, shells shown and described by Mr. Kimber and his helpers, and woods from the S.A. Woods and Forests Dept. all added to the attractiveness of the Show.

The South Australian Aquarium Society made a fine exhibit of fishes and aquatic plants.

The competition in paintings brought many fine examples of flower painting.

The prizes for schools were awarded as follows:—Basket Range, Myponga, Monarto South, Crafers, Hermitage, Mylor.

During the evening sessions illustrated lecturettes were given by Mr. Bellchambers, Mr. M. H. Hale, Dr. Basedow and Mr. J. F. Bailey and Mr. A. M. Lea.

Messrs. J. M. Black and J. F. Bailey judged flower exhibits and Miss M. Grigg the paintings. Space will not permit of mention of the many members who worked with such splendid spirit on the various committees.

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ANNUAL MEETING, AUGUST 21, 1928.

The forty-fifth annual meeting of the Society was held at the society's rooms on August 21st, under the presidency of Mr. W. Champion Hackett. The annual report, read by the honorary secretary (Mr. E. H. Ising), showed 188 members, new members totalling 31. Three members had been removed by death—Mr. Edgar R. Waite, the highly esteemed and distinguished Director of the S.A. Museum; Mr. W. J. Webb, an enthusiastic worker of the microscopical section, and an energetic worker at the annual

Wild Flower Show; and Mrs. E. Drummond, who was popular among the members. During the year 27 excursions by tram, train, launch and charabanc had been undertaken for the study of native flora, aquatic life, entomology, geology, bird life, mollusca and crustaceans, physiography, orchids, wattles, fruit culture, cultivated native plants, and Australian trees. Lectures (some with lantern slides) had been given by Mr. T. P. Bellchambers ("The Life History of the Mallee Fowl"), Dr. Fenner ("Petrology" and "Chick Development"), Mr. W. A. Harding ("Floral Organs"), Mr. H. M. Hale ("Crustaceans"), Rev. H. A. Gunter ("Foraminifera"), Mr. F. B. Collins ("Histology"), Mr. J. W. Hosking ("Aquatic Plants"), Mr. Wilson ("The Water Flea"), Mr. C. T. White, F.L.S., Government Botanist, Brisbane (on "Rain Forests of Queensland and New Guinea"), Sir William Sowden ("Penology"), Professor J. B. Cleland and Mr. E. H. Ising ("Botany"), Mr. W. Ham ("Physiography of Tasmania"), Mr. W. J. Kimber ("Life on a Coral Island"), Mr. P. H. Williams ("Peeps into Other Lands"), and Mr. A. G. Edquist ("Our Birds"). The S.A. Naturalist, the journal of the section, during the year had contained contributed articles by Professor Cleland, Messrs. H. M. Hale, P. S. Hossfeld, B.Sc., W. J. Kimber, N. B. Tindale, J. Sutton, and J. T. Cunningham, and Dr. C. Fenner, and reports of lectures and excursions. The editor is Mr. W. Ham, F.R.E.S., Adelaide University. The ninth annual wild flower show in the Adelaide Town Hall, last September, had yielded a net profit of £45. The work in the herbarium, under Professor J. B. Cleland, had made substantial progress. A new species of Olearia, with other specimens, had been sent from Burrungul School. Many specimens from the flower show, sent by other schools, were named and pressed. Two new species, *Stipa nitida* (a spear grass), and *Swainsona adenophylla*, were received from Mr. F. D. Warren, of Finnis Springs. The herbarium had been used by Mr. J. M. Black in compiling his "Flora of South Australia." Miss I. Roberts, librarian, had resigned, and Miss M. Roeger had been appointed to the position. The annual report of the fauna and flora protection committee was presented by Mr. J. E. Lewis Machell. It referred to measures taken by the Government to preserve the native currant (*Acrotriche aepressa*) and to the question of saving the grey kangaroos at present found in certain part of the Adelaide hills. Mr. Harding read the report of the Microscopical Section, alluding to the revival of this section for the study of minute life. The subjects covered ranged from foraminifera to histology. Several members of

technical ability promised lectures during the ensuing year. The meetings are held in the Royal Society's rooms on the last Tuesday evening of every month. The third annual report of the shell collectors' committee was read by Mr. F. Trigg. The committee had had a successful year, and numbered 25 members. A preliminary survey had been made of the molluscan class of *Gasteropoda* and *Scaphoda* (tooth shells), *Polyplacophora, Cephalopoda* (cuttle fish), and *Brachiopoda* (lamp shells), and surveys were in progress in the class *Pelecypoda*. The treasurer (Mr. F. Trigg) showed a credit balance of £23. The chairman (Mr. W. C. Hackett) read an instructive address covering most of the phases of the sections' activities. In the election of officers, Mr. H. M. Hale was chosen as chairman, and with few exceptions, the old committee were re-elected.

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EXCURSION TO WATTLE GROVE, SOUTH PARK LANDS, AUGUST 18, 1928.

Members of the Section met Sir William Sowden at the Wattle Grove. Sir William conducted the party through the plantation, and in an interesting chat explained the twofold purpose of the Wattle Day League—the aims being to keep green the memory of the heroic men who gave their lives in the war, the intention being that each of those who fell should be represented by a tree planted by a near relative, and the second aim to inculate in the rising generation a love of Nature, and particularly of our indigenous flora—so unique and quaintly beautiful. It was the purpose to have an acacia in bloom during every month of the year, so that the cycle of seasons might always have a representative in the dainty and exquisite wattle blossom. The movement had had its origin in South Australia, but had spread to every State of the Commonwealth and to New Zealand. It owed its inception to Mr. and Mrs. Walter Torode. Starting from the granite monument erected in memory of the landing on Gallipoli, the plantation extends from South terrace to Park terrace, Wayville, and comprises a broad avenue of acacias and other Australian trees, with several irregular areas similarly planted. Among the wattles were noted *A. pycnantha, A. cultriformis, A. longiformis, A. armata, A. decurrens,* and several other varieties. Unfortunately, vandalism has not spared this valuable reserve. Fresh trees have been planted in place of these, and some have flourished and attained considerable dimensions. The

soil is not altogether suitable, and in the lower parts needs draining. Every visiting Governor, the Governor-General and their ladies have planted a tree in this historic grove. An interesting memorial is a tree that was dropped from his aeroplane by the late Capt. H. Butler on Wattle Day, 1919, and was planted by His Honor the Chief Justice (Sir George Murray). In this exploit Capt. Butler nearly came to grief, as the tree got entangled in the cordage of his machine.

EXCURSION TO WARPOO, NEAR LYNDOCH, SEPTEMBER 8, 1928.

A small party under the leadship of Mr. E. H. Ising, travelled by rail motor to Warpoo and spent a delightful day among the native flowers near the Warpoo siding. Several varieties of the carnivorous Drosera (Sundew) included *D. glanduligera* which differed from the ordinary kind in bearing red instead of the usual white flowers also *D. Whittakeri* and *D. Menziesii*, *Dianella* (little Diana), *Bulbine bulbosa*, *Grevillea lavandulacea* (sometimes known as cat's claws) with its long red protruding styles, *Helichrysum* (golden sun), a composite everlasting, *Kennedya prostata* (red or scarlet runner), *Dillwynia* and the golden-brown blossoms of *Pultenaea laxiflora*, also *Swainsona lessertifolia*, *Enchylaena* (succulent cloak) *tomentosa* (covered with hairs), *Calotis hispida*, *Schoenus*, *Leucopogon*, (white beard), *Myoporum viscosum*, a species of speargrass (*Stipa*), Pimelea, known as rice grass, buttercups (*Ranunculus lappaceaus*) added interest and colour to the pleasant ramble.. *Microseris* (little lettuce) the native yam, *Astroloma conostephioides* and *A. humifusa* (spread on the ground), *Velleya paradoxa* (known as the native pansy), the white flowering *Stylidium despecta*, *Hydrocotyle* (small water cup), *Polypompholyx* (many bubbles), *Chthonocephalus* (grand head with silvery leaves), *Calotis* (lovely ear), *Helipterum* (winged sun), the "wild hop" (*Dodonea viscosa*), several species of *Crassula* with thick succulent leaves only 1 inch high, some with stalks and little red scale at the base of the petals. The snake tongued fern (*Ophioglossum*) was widely distributed. The shrubs *Daviesia* and *Dillwynia* were also in flower. Orchids were represented by the dainty *Diuris* (two tailed) *maculata* (spotted) with its brown and yellow spots, *Caladenia reticulata* (the spider orchid). The trees included acacias (wattles), native pines (*Callitris*), and eucalypts. Acacias included *A. armata* (prickly), *A. calamifolia* (reed leaved), *A. continua*, *A. spinescens*. The *Portulacca* (milk carrier), *Caladrinia* is distributed through the greater part of South Australia. The fleshy leaves contain abundant moisture. In the sandhill pastoral country large areas

covered with its beautiful purple flowers form a pleasing picture and moreover it has valuable fodder qualities. It is known as "parakylia," and cattle remote from any water can live for weeks on this succulent herbage.

EXCURSION TO PORT WILLUNGA, SEPTEMBER 29,1928.

A small party journeyed to Port Willunga per charabanc but the exceptionally stormy weather drove them to take refuge in the vehicle and return to the city.

EXCURSION TO MYPONGA, OCTOBER 10, 1928.

On Wednesday, October 10, under the leadership of Dr. J. B. Cleland, members of the Field Naturalists' Society visited Myponga on botanical investigation. The bush proved very rich in native flora, but the season was rather early for blossoming. *Hibbertia* (Guinea flower) decked the hills with their golden bloom. The deep azure of *Cheiranthera*, with five yellow stamens, was significant of its scientific name meaning "hand-flower." The white left-handed *Scaevola* owes its romantic name to an ancient legend. Orchids included *Caladenia carnea* (flesh coloured), *C. dilatata* (spiders), *Glossodia major* (the tongue orchid), *Thelymitra ixioides*, *T. rubra* (lady's red headdress), *T. antennifera*, and *Diuris*. The carnivorous *Drosera* (sundew were in great numbers, including *D. glanduligera* and *D. auriculata*. Other blooms collected were *Chamaescilla corymbosa*, *Caesia vittata* (blue lily), *Hydrocotyle* (wild carrot), *Viola Sieberiana*, *Isopogon ceratophyllus* (horny leaf), *Leptospermum*, *Platylobium obtusangulum* (wild ivy, one of the most beautiful of native flora), *Helichrysum* (golden sun, a gorgeous everlasting), *Dillwynia hispida* (hairy), *Microseris* (little lettuce).

EXCURSION TO ALDGATE, NOVEMBER 10th, 1928.

Under the guidance of Dr. C. Fenner,a party of members of the Field Naturalists' Section spent the afternoon of the 10th of November in the study of the physiography of the Adelaide Plains and of the Mount Lofty hills. A first stop was made at the Glen Osmond quarries. In the steep scarp the bedding of the blue slates and the quartzites was clearly observed. These rocks had been deposited in successive horizontal strata in shallow water millions of years ago, and the layers had been slowly uplifted during the ancient mountain building period to an angle of 45 deg. A broad vein of quartz, brown and weathered, could be clearly traced about midway in the cliff. This well-defined mass had found its way through cracks in the sedimentary rocks while the quartz was in solution. The joint planes, at right angles to

one another were of great service to the quarrymen, enabling them, with comparative ease, to dislodge large blocks of stone. At the Eagle-on-the-Hill the party left the charabanc and from a favorable vantage point obtained an extensive and magnificent view of the city and its environs from the gulf to the foothills, and north in the direction of Gawler. From this spot it was easy to follow Dr. Fenner's account of the many gradual but stupendous geological changes that had prepared this great fertile tract for the abode of man, and to conjure up pictures of the landscape in those remote ages. First, a vast ocean rolled over the plains from the Great Australian Bight eastwards to the Victorian Grampians, and north almost to Broken Hill. During that submergence millions of marine creatures lived and died in the waters, and their skeletons, sinking in the ooze, had in the course of countless milleniums, formed vast beds of limestone. Then followed a period of very slow but continuous uplift, and the limestone layers rose above the retreating waves. The Mount Lofty Ranges were uplifed and the two gulfs were lowered. Torrential rains scored channels to the soft rock, rivers and creeks began to flow, carrying in their streams fragments of rock, gravel, sand, and mud, and spreading them down to the shallow waters near the present coastline. The same irresistible process was going on to-day before our eyes, and the Torrens was laying down its load of silt and detritus behind the sandhills of Henley and Grange; and nothing that they could do would arrest this upbuilding of the great delta plain.

Dr. Fenner pointed out the succession of shelves or platforms that form a step-like front to the Mount Lofty Ranges. At the Croydon bore is an ancient block 1,000 feet below the surface covered with marine and river deposits. At Kent Town there had been found another block 400 feet down, similarly capped with limestones and muds. The Burnside block was 500 feet above sea level. The Belair block stood at 1,000 feet; the Sturt block at 1,600 feet, and above that rose the dominant Mount Lofty block. A short pause was made at a quarry between Glen Osmond and Eagle-on-the-Hill, where Professor Sir Edgeworth David claimed to have found the most ancient fossils yet discovered.

Farther on the road to Mount Lofty Mr. E. H. Ising called attention to the marked distinction in the vegetation of the rounded grassy hills formed by layers of slate and clay, and sombre forests of the Stringy-bark growing on beds of hard quartzites.

COMBINED EXCURSION WITH CAMERA CLUB, OCTOBER 27, 1928.

On October 27, the Camera Club joined with the Field Naturalists' section of the Royal Society in an excursion to the National Park. Many wild flowers were in bloom, and the party followed the path that led through the tunnel under the railway and up the rocky gorge to beetling rocks, which might have provided a stupendous waterfall if the water had not been practically non-existant. From a rocky ledge Mr. W. Ham discoursed on the way in which those mighty cascades had been formed, and stretched the imagination to breaking point by comparisons with Niagara and with the Victoria Falls on the Zambesi. He pointed out that the towering rock faces consisted of materials differing greatly in hardness and in resistance to the action of the acids found in falling and running water. The softer rocks in the course of the stream, such as lime, sandstone, and iron, were decomposed by carbonic acid or rusted by oxygen, and the refuse had been carried away by running water. Even in dry countries like our own there was a "skin" of moisture deposited on the rocks which acted as a solvent; and wind, grit, and water removed this, exposing fresh surfaces to repeated attacks. The harder quartzites, of which the bulk of the strata consisted, resisted these agents of disintegration and formed a barrier over which the angry water had tumbled in surging foam, thus forming one of the most beautiful sights in Nature. As the softer material was swept away, great gorges shut in with sheer precipitous rock faces were gradually scooped out. By that unintermittent but almost imperceptible action, hese rocky sides had been gradually rounded off and valleys shaped like the letter U were formed in the lower reaches, known as "Old Valleys;" while in the upper course of the stream the steep V-shaped channel betokened a "Young Valley." The rate at which the waterfall had retreated up the valley had depended on the character of the rock, the quantity of the rainfall and the steepness of the descent.

———:o:———

THE MICROSCOPIC COMMITTEE.

The past year as seen an effort to re-establish the Microscopic Committee of the Field Naturalists' Section of the Royal Society.

The Committee which functioned so successfully for many years under the inspiration of the late Mr. Bradley had unfortunately been allowed to lapse, and it was felt by several members of the Section that members should have the opportunity to demonstrate the microscopic sections of their various subjects, and incidentally gain an insight into the field of other workers.

Energetic efforts have therefore been made to encourage the work of the Committee, and the membership in active attendance is steadily growing. Subjects considered have ranged from Histology to Foraminifera and studies in Pond Life. All subjcets have been amply ilustrated with suitable slides, specimens, etc., and have proved extremely interesting to all present.

For members who have not the advantage of advanced technique with the Microscope here is an opportunity to gain experience from others and use instruments that may be beyond their individual possession. In addition to the use of the excellent microscopes kindly lent by the Royal Socitey, a number of useful and unusual instruments have been demonstrated by some of the members.

In addition to the instruments mentioned, the Committee is indebted to the Royal Society for the use of the Room of meeting, and, also, it is hoped that in the near future the excellent library (on matters microscopic) will be placed at the Committee's disposal.

An appeal is made to all interested to link up with the present members of the Committee, as it is felt that much mutual benefit can be so gained. Further information can be obtained from the President (Mr. A. W. Harding) or the Secretary (Mr. Collins, c/o Customs House, Port Adelaide).

—X—

THE PLANTS OF THE ENCOUNTER BAY DISTRICT NOTES ON THE ECOLOGY (Concluded).

By J. B. Cleland, M.D.

Continued from Vol. IX., No. 4, August, 1928, p.p. 57-60.

VIII. Hill-slopes and Gravelly Sandy Loam and Clay Subsoil with widely dispersed *Eucalyptus fasciculosa*, etc.

The type of vegetation presented by this area is an open forest, usually of *Eucalyptus fasciculosa* (Pink Gum) with some *E. leucoxylon* (Yellow Gum), the trees being widely separated

so as to leave plenty of exposure to sunlight. Between and under the trees are various shrubs and under-shrubs. The soil varies somewhat with corresponding slight variations in the plants, either as regards species or as regards relative prevalence. A good example, now however being cleared for sowing subterranean clover, may be seen on the south side of the Inman Valley road, opposite the turn-off to the Hindmarsh Tiers and the residence formerly of Mr. and Mrs. Moulden. This hill is a sandy loam with small glacial erratics and some gravel with a more clayey soil below. In addition to the two Eucalypts mentioned, *E. viminalis* (Manna Gum) grows near small creeks descending from the area, and there are a few She-oaks (*Casuarina stricta*) and occasional Native Cherries (*Exocarpus cupressiformis*). As regards the taller shrubs, there are thickets of *Casuarina striata*, the plants as usual being upright and twiggy. These were in flower in September, 1928—female plants with cones were most abundant, the "male" plants with their yellowish stamens showing usually also a few cones. A few plants of *C. Muelleriana*, forming more rounded bushes, were present, the males in flower with stamens redder than those of the previous species. One plant of *C. pusilla*, in this case growing to a height of three and a half feet, was noted. Other tall shrubs irregularly scattered comprise Golden Wattle (*Acacia pycnantha*), Kangaroo Bush (*A. armata*), *Pultenaea daphnoides* in moister parts, *Xanthorrhoea semiplana-Tateana*, and in wetter parts *Leptospermum scoparium*. Of lower shrubs passing into under-shrubs, *Hibbertia stricta* was dominant in places as small separate bushes and there were scattered examples of *Leptospermum myrsinoides*, *Acacia myrtifolia*, *A. verticillata*, *Hakea rugosa* and less frequent *H. rostrata*, *H. ulicina*, *Isopogon ceratophyllus*, *Pultenaea largiflorens* var. *latifolia*, *Platylobium obtusangulum* and *Olearia ramulosa* var. *microphylla*. A small colony of *Melaleuca decussata* was composed of low plants. A still more lowly level in plant height, somewhere about a foot, was represented by the sedge *Lepidosperma concavum* which in places had nearly taken complete possession. Tufts of *L. carphoides* were numerous. Kangaroo Grass (*Themeda triandra*) was common. Other grasses were occasional only and comprised *Neurachne alopecuroides*, *Stipa*, *Danthonia*, *Briza maxima* and *Agropyrum scabrum*. The Wood-rush *Luzula campestris* comes up in the spring but is not common. *Juncus pallidus* was in water-courses. The Carrot Fern (*Cheilanthes tenuifolia*) was frequent. There were a few Liliaceous plants such as *Dianella revoluta*, *Lomandra dura*, *L. glauca* and *Dichopogon* (in spring). There were also a few

plants of *Cladium junceum, Hypolaena fastigiata, Rumex Brownii, Ranunculus lappaceus, Dillwynia hispida, Pelargonium australe* var. *erodioides, Stackhousia monogyna, Leucopogon concurvus, Halorrhagis tetragyna, Helichrysum apiculatum, Erechtites* and *Craspedia Richea.* The spring orchids may be mentioned here, of which a *Thelymitra, Lyperanthus nigricans* in leaf, a *Diuris, Caladenia deformis* and *Glossodia major* were noted. Prostrate spreading plants consisted of *Kennedya prostrata* (Scarlet Runner), *Bossiaea prostrata, Astroloma humifusum* (Native Cranberry) and *Dichondra repens.* Of about the same height were small tufted plants such as *Schoenus apogon* and *S. Tepperi,* small grasses as for example *Aira caryophyllea, Briza minor, Poa annua* and *Festuca myosuros,* and small dicotyledons as *Rumex acetosella* (Sorrel), *Cerastium glomeratum* (Mouse-ear Chickweed), *Drosera auriculata* and probably *D. peltata, Oxalis corniculata, Hypericum gramineum* and *Microseris scapigera,* most of which were in few numbers.

The minute spring ephemeral plants are an interesting feature of the lowest level of vascular plants. They flourish for a few weeks in the moist, sandy soil of this and many other areas in the district. Amongst these were noted *Triglochin centrocarpa,* the small neat tufts of *Scirpus antarcticus, Centrolepis aristata* and *C. strigosa, Anguillaria dioica, Hypoxis glabella, Calandrinia?, Drosera Whittakeri, D. pygmaea, Crassula Sieberiana, C. macrantha, Hydrocotyle callicarpa, Millotia tenuifolia* and *Rutidosis pumilo.*

Of parasitic plants, *Loranthus Miquelii* occurred on *Eucalyptus fasciculosa* and the two False Dodders, *Cassytha melantha* and *C. glabella,* climbed round various plants.

Occasional examples of the following plants were also noted: *Chamaescilla corymbosa, Bartlingia sessiliflora, Grevillea lavandulacea, Rosa rubiginosa* (Sweetbriar), *Acaena, Acacia spinescens, Trifolium procumbens, Viola Sieberiana* and *Hypochaeris radicata.*

— Miscellanea —

Bay of Biscay Semi-swamp. *Lepidosperma concavum-Chorizandra enodis-Callistemon rugulosus* Association.

In places on the landward side of the scrub stretching towards Newland's Head are areas of Bay of Biscay ground, consisting of circular depressions a foot or so deep and several yards across, separated from each other by round ridges. This country is dry in summer but the depressions, having clay bottoms, hold water or are moist in winter. One such area, about a mile and a

half from the Bluff, occupies several acres and as the vegetation presents some peculiarities, it seems worth describing. The predominant plants are *L. concavum*, occupying the ridges and competing with the less abundant *C. enodis* for the drier hollows. *C. enodis* is abundant and often alone in the deeper depressions, a type of situation—partly submerged or damp in winter—apparently always taken by this sedge. The plants give a distinct colour-tone to the areas on which they occur. Next to these two, *Callistemon rugulosus* is abundant on many ridges and is very beautiful, with its crimson stamens, when in flower, though the shrubs are low and rather spread out. Hardly noticeable but often producing a considerable harsh sward on the ridges is *Schoenus Tepperi*. Low shrubs of *Eucalyptus cosmophylla* and small plants of *Melaleuca decussata* are not uncommon. *Hakea rugosa* also favours this yellow clayey soil, the shrubs being numerous in parts. *Acacia farinosa* is met with here but not elsewhere in this district. Not uncommon and found as yet nowhere else in the district is the pretty, low Rhamnaceous plant *Pomaderris obcordata* with bifid ends to the leaves. *Eutaxia microphylla* is scattered throughout and a colony of *Styphelia exarrhena* was found. Near this were two plants of the rare *Leucopogon Clelandii*, flowering in May, in which month at Coonalpyn it was first found about 16 years ago and has only been found once since at Kangaroo Island. There were a considerable number of plants of *Acrotriche affinis* with their prickly leaves. The following additional plants were few in number and did not participate appreciably in making up the facies:—A few scattered grasses, *Juncus pauciflorus*, *Dianella revoluta*, *Lomandra dura*, the orchid *Orthoceras strictum*, *Grevillea ilicifolia* (near the edge), *Cassytha glabella*, *Drosera Whittakeri*, *D.* sp. (upright stem), *Daviesia ulicina*, *Oxalis corniculata*, *Phyllanthus australis*, *Hibbertia* (fairly common), *Pimelea*, *Eucalyptus leucoxylon* (low), *Halorrhagis teucrioides*, *H.* sp., *Astroloma humifusum*, *Dampiera*, *Goodenia ovata*, *Cassinia aculeata* and *Calocephalus citreus*.

New Vegetation on Shifting Strand.—Sand blocks more or less the exits of the Hindmarsh and Inman Rivers. Floodwaters on the one hand and exceptionally high tides on the other tend to break down and shift the accumulation of sand. In summer, often neither stream has any escape for its water. During 1927 some alterations occurred at the mouth of the Inman and a portion of the exit, previously bare sand, had more sand, probably with some silt as well, superadded so as to give harbourage to plants. Of this, advantage was soon taken so that a number of

young plants were noted in January, 1928, and these had considerably increased in size by May. The plants were scattered over the area and the following were noted as having been able to establish themselves in this newly-made bed:—The grasses *Spinifex hirsutus*, *Sporobolus virginicus*, *Polypogon monspieliensis*, *Lagurus ovatus*, *Phragmites communis* (died out by May), *Festuca rigida*, *Bromus* probably *B. madritensis*, *Lepturus incurvatus* and *Hordeum*, the sedge *Scirpus nodosus*, *Rumex* sp., *Emex australis*, *Polygonum aviculare*, *Rhagodia baccata*, *Chenopodium murale*, *Ch. glaucum*, *Atriplex cinereum*, *Salsola kali*, *Suaeda australis*, *Enchylaena tomentosa*, *Lythrum hyssopifolia?* (one plant), *Oenothera odorata* (one), *Lycium ferocissimum* (Boxthorn, one), *Datura stramonium*, *Plantago lanceolatus* (few), *P. coronopus* (abundant), *Olearia axillaris* (one), *Cryptostemma calendulaceum*, *Cirsium lanceolatum*, *Sonchus oleraceus* and *Hypochaeris radicata*.

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Owing to pressure on our space an interesting article on aboriginal carvings has been held over to the next issue.

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ADDITIONS TO OUR LIBRARY.

1. The Australian Museum Magazine, Vol. III., No. 8. Articles on the Bicentenary of the birth of Captain James Cook and on "New Guinea: Land of the Devil Devil" are particularly interesting.
2. Journal of the Arnold Arboretum, July, 1928.
3. The Queensland Naturalist, July, 1928.
4. The Victorian Naturalist, August, September and October Numbers
5. Journal of the Royal Society of Western Australia, Vol. XIII., 1926-1927. The first paper contains the names of Fifty New Species and Six New Varieties of Western and Northern Australian Acacias. The Volcanic History of Western Australia by A. Gibb Maitland is another notable contribution.
1. On the Barrier Reef.
2. Report of the Victorian Naturalists' Expedition through the Western District of Victoria in October, 1927. The tour was organised by Mr. E. E. Pescott, F.L.S., to visit part of the Grampians in Western Victoria. The report, which is well illustrated, gives a full account of the botany and physiography of this region with notes on the insect life etc.
3. The Peopling of Australia. Issued for the Institute of Pacific Relations. Edited by P. D. Phillips and G. L. Wood. The Essays deal with great Australian Problems of Population, Immigration, Eugenics, Industries, Climates, White Settlement of Australia, etc

The South Australian Naturalist

The Journal of the Field Naturalists' Section of the Royal Society of South Australia and of the South Australian Aquarium Society.

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EXCURSIONS.

March 9—Aldgate Show. Train, 2.3. Leader, Mr. Morrison.
March 16—Snake Park (North Adelaide) With the Aquarium Society. Leader, Mr. Hale.
April 6—Hallett's Cove. Train, 1.38 p.m. Geology, etc. Leader, Dr. Fenner.
April 25—Thursday (Anzac Day). Montacute.
May 4—Outer Harbour. Shore Life. Leaders, Shell Club.
May 18—Burnside Waterfall.

LECTURES.

March 19—Exhibit Evening:—
1. Mr. J. F. Bailey, "Some Australian Flowers."
2. Mr. W. J. Kimber, "Shells."
3. Mr. W. A. Harding, "Microscope subject."

OUR EXCHANGES.

1. The Australian Naturalist (N.S.W.), September and December Numbers.
2. The Victorian Naturalist. December and January Numbers.
   Messrs. Pescott and Nicholls report the finding of a new species of Orchid named *Caladenia Hildae.*
3. Queensland Naturalist. November Number.
4. The South Australian Ornithologist. October and January Numbers.

The
South Australian Naturalist.

Vol. X. FEBRUARY, 1929. No. 2.

HABITS OF SOME AUSTRALIAN FRESHWATER FISHES.

By Clarence F. Blewett, South Australian Aquarium Society.

The following notes are the result of observations of some of our small freshwater fishes, carried out during the last two years. Breeding behaviour was observed in large rectangular aquaria, 24 inches in length, 11 inches in width and 12 inches in depth. These contained about 12 gallons of water each, and were well aerated with growing aquatic plants.

I consider that care of the fish prior to the breeding season has a marked effect on the results obtained. Fishes which I hope to induce to spawn in my tanks are installed in 12 gallon aquaria throughout the winter and the temperature is maintained in the vicinity of 70°F. so that with the advent of spring the fish are in excellent condition. This is particularly necessary in the case of those which exercise parental care of the eggs.

MOGURNDA ADSPERSA (Castelnau).

This fish, popularly known in South Australia as the Chequered Gudgeon or "*Krefftius*", is moderately common in the River Murray system, and according to Hale (1) was at one time plentiful in the River Torrens, where it was used by anglers as live bait for the introduced European Perch.

It is well known, to those who search for *Mogurnda*, that repeated visits to pools and lagoons which the fish is known to inhabit may be without result in the winter, but that in the spring and summer numerous examples are found in these situations. It therefore seems probable that the fishes migrate from deeper water or the main body of the streams in the summer time and spend the winter in sheltered situations in the last-named. Gently running or almost stagnant, clear waters are preferred to any other: secluded situations on weedy ground are selected as a rule, but the fish spends part of its time poised in

(1) Hale, Aquatic Life, iv, 1919, p. 148.

open spaces between vegetation, resting motionless on weeds near the warmer surface water, or resting on the bottom. The species rarely swims continuously for long distances, but progression is accomplished in a series of jerky darts. The caudal fin is often used to propel the fish, but the pectorals are used to a much greater extent when it is moving about quietly. Although numbers of the species may be present in one pool, they do not congregate in schools.

A good method of capturing the fish is by using a handnet, preferably rectangular in shape, with a bag of about 18 inches in length attached at right angles to a stick some 8 to 10 feet in length. The net is thrust out amongst the water-weeds and quickly drawn in towards the bank with a downward swoop. The net need not be entirely immersed for, as previously mentioned, the *Mogurnda* likes to bask in the sun, resting on the weeds near the surface.

The natural food consists of young yabbies, shrimps and insects. In aquaria the fish readily accepts living earthworms, while scraped beef is taken by examples accustomed to life in tanks. Food is taken voraciously, the fish making a determined drive to secure it, turning almost on one side. Feeding takes place at any time during the day and in summer food is accepted every day, although in winter comparatively little is eaten.

The rate of respiration varies very greatly with temperature, excitement, etc., but the gill movements of a quiet fish, at 80° F. are about 108 per minute.

Like most of our native fishes, *Mogurnda adspersa* is very subject to attacks of *Saprolegnia* in aquaria if the temperature of the water drops below 60°F.

The sexual differences are not very pronounced, the male usually having a slightly blunter head than the female. The surest way to distinguish the sexes is of course in the breeding season, when the ripe female has a swollen abdomen, and the milt in the male shows much more inner white than formerly. Some aquarists maintain that the males have the posterior ends of the dorsal and anal fins more produced than those of the females, but as I have a ripe female whose fins are more pointed at the tips than are those of her mate, this difference can hardly be considered of much value.

Although no special seasonal characters are developed both sexes become deeper in colour during the breeding season, which commences in the spring and, under good conditions, continues

during the whole of the summer when the temperature of the water rises to between 65° and 80°F. My breeding fish are about 3 inches in length, but a few larger examples have been taken.

The late Albert Gale successfully bred the species in aquaria sixteen years ago and briefly described its breeding habits (2). American aquarists became interested in Gale's account and in 1918 one enthusiast, Erwin O. Freund, with the assistance of the late H. G. Finck of Sydney, transported a number of living Australian freshwater fishes to America, including 11 specimens of our Gudgeon. These spawned in August, three months after their arrival (3).

My first effort to breed this fish was made in 1927. About August I was practically certain of the sexes I had, three pairs, as three fish were obviously heavy in spawn. On November 17th I selected a well-matched pair and provided them with two stones placed together to form a small cave. The male soon found his way into, and inspected the retreat, which was so arranged that the spawn might be easily viewed.

The love-making was very pretty. The color of the male deepened to a rich sky-blue and as he swam around his mate he erected every fin to the fullest extent, and also expanded the gill covers, reminding me of a peacock showing off his plumage. This courting went on for some days, until at last he coaxed his consort into the little cave. The following morning (Nov. 22nd) the female spawned on the stone and all the ova were in plain view. There were about one to two hundred elongate eggs, arranged very closely together. The male continuously fanned the eggs with the pectoral and anal fins, with his body in various positions; at times he was head-downwards, and occasionally his fanning was so vigorous that I was afraid he might cause the eggs to become detached from the stone. He was very jealous of his charge; on several occasions the female approached the eggs but each time this resulted in a vicious attack by the male, and the loss of some part of a fin of the female; at times the male left the eggs and drove his mate about, so that she soon became a very dejected looking fish and was removed. No ova were infertile; they developed fairly quickly, then owing to a cold snap the temperature dropped, the young took 14 days to hatch, and were weakly and died.

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(2) Gale, Aust. Zool., i, 1924, p. 25, and Aquarian Nature Studies, 1915, p. 18 and Aquatic Life, iii, 1918, p. 146.

(3) Aquatic Life iii, 1918, p. 164 and iv, 1919, p. 33.

Subsequent spawnings turned out quite satisfactory; one which I witnessed, occurred at 6.30 a.m., the water temperature being about 82°F. and the same stone as before being used. I arranged the aquarium so that if the temperature dropped it could be heated. The female deposited about 30 eggs then waited for the male to do his part. That having been done she deposited a further batch. This went on until eventually the male seemed not so anxious to fertilize the eggs as before and remained on the bottom of the aquarium. The female then pushed him with her snout and he again attended to his duties until the spawning was completed. After the deposition and fertilization, the female showed no interest in the welfare of the spawn, excepting when, as previously noted, she approached the nest after the male had taken charge, and then possibly the ova would have been eaten by her but for the intervention of the male. A few infertile eggs were present but these were brushed off by the male while aerating the batch. The remaining eggs hatched in three days, when the male was removed. The young fry, as in other broods observed by me, seemed quite incapable of swimming properly; they lay about the bottom seemingly dead, then, with great effort, attempted to get to the surface. This went on for about 36 hours and only about one-half of the fry succeeded in becoming balanced, the rest dying at the end of this period when the egg-sac was absorbed.

In the case of the first batch of spawn I attributed this preliminary helplessness and high mortality of the young to the too-prolonged period of incubation, and in the case of the second, to the fact that the temperature was too high during incubation, but later the same thing happened to fry that were hatched in a tub in the open, from different parents; these experiences may be merely coincidences, for Gale's description of the breeding habits of these fish does not mention any difficulty with the fry getting their equilibrium, and I am at a loss to say what the cause might be.

During the incubation period the male ate very little; he would eat two or three worms at infrequent intervals but would touch no small live food. It is significant and, to me at least, of great interest as exhibiting a natural tendency to protect the fry, that during the breeding season both *Mogurnda adspersa* and *Melanotaenia nigrans* refused to eat mosquito larvae, which to some extent superficially resemble the young fishes.

MELANOTAENIA NIGRANS (Richardson).

This species ranges from New Guinea to the eastern and southern rivers of Australia, and is common in the Murray River and its tributaries. The spot which has led to the popular appellation "Pink-ear" is not apparent in South Australia examples, in fact southern specimens differ considerably in color from those occurring in tropical Australia. Although perhaps less pigmented, these southern examples lose nothing in beauty, for the iridescent reflections of the fish render it one of the most beautiful of the inmates of aquaria. The species apparently prefers clear, still pools with muddy bottoms and weed, but also occurs in the cloudy water of the main stream of the Murray River.

In aquaria at night the fish can be seen apparently sleeping (if the light be switched on), resting on the bottom (on the abdomen), or on the weeds, in most quaint positions, sometimes head downwards. In the day it is rarely on the bottom but remains poised in midwater. In swimming it makes swift darts forward for a few inches then remains poised, but it is capable of darting about very quickly if alarmed. The pectoral fins are used for poising and are vibrated about 70 times per minute; between each vibration the fins are brought back close to the body and there is a distinct pause. The caudal is used for all forward movements, except for travelling very short distances when only the pectorals are utilised. The dorsal in the female is always erect; in the male (that fin being longer) it is erected at the fullest only at times of excitement, such as during feeding or when frightened. At 80° F. the gill movements are about 220 per minute.

When in clear water, especially on a sunny day, the species nearly always congregates, in schools of 20 or more, swimming close to the warmer surface layer of water.

Almost any small living aquatic animals are eaten; food such as mosquito lavae, Daphnia, or small chopped worms (if seen while sinking to the bottom) is taken with a swift dash. Anyone who has fished in the Murray knows how one gets moderate tugs at the line which result in the loss of the wriggling ends of the worms. This is in many cases due to these fish dashing past and biting at the struggling bait. Food is taken at any time in the day if the temperature is 65°F. or over; in the winter the fishes eat little.

Six of these fish were kept heated throughout the winter in a 12 gallon aquarium and fed on chopped worms and live food such as mosquito larvae and *Daphnia*, the swimming live food

being taken more readily, as when the worms sank to the bottom it was only the exceptionally lively examples which attracted their attention. The fish is not a "bottom feeder" normally, but in an aquarium it soon learns to feed off the bottom after a few days of hunger, and looks rather quaint swimming head downwards after the fashion of our carp when ground feeding, only in an even more vertical position.

For aquarium purposes the fish may be captured with a net similar to that described under the account of *Mogurnda*, but without the long handle, a short stick, 8 inches to a foot in length being sufficient. The end of the net is folded and placed on top of the frame furthest away from the handle. A bait consisting of a lively earthworm is then tied to a piece of string about a foot long, which is attached to the top end of the net. The bait is then immersed in the water (which must not be too clear), in a shady spot, just deep enough to see it, and presently a flash of a fish will be seen and a slight tug will be felt. Then coax the Pink-ear nearer to the surface and when it gets a little more confident it will remain by the bait for a second, when a quick downward sweep will in nearly every case secure the fish, the bag of the net unfolding whilst entering the water.

The transportation of the Pink-ear is fairly difficult owing to its habit of dashing wildly about when caught, and also of jumping up out of the water and injuring itself on the top of the can or other receptacle; this usually results in *Saprolegnia*, to attacks of which the species is apparently very susceptible. This can be overcome to a great extent by placing the freshly caught example in a screw-top mineral-water bottle, quickly laying the latter on its side so that the fish cannot jump, and also covering the bottle so that the fish is in the dark. Care must be taken that the bottle is not filled with water, (about 3 square inches air space being left for aeration), and that the stopper is tight. This applies generally to the transportation of any fish. Two fish which will just pass through the neck of our screw top bottle will safely survive a 3 hour journey providing they are kept cool and get a good deal of shaking to keep the water aerated. No more should be put in the bottle, which can be kept cool by wrapping in a wet bag or cloth, evaporation keeping the temperature down. Never force the fish in the bottle neck, as this is sure to result in swim-bladder trouble. If, however, the fish become damaged or bruised in transit, a white spot of the fungus *Saprolegnia* will appear in a few days, usually on the snout. This can be easily cured, if attended to

immediately, by placing the fish in an aquarium and adding two heaped teaspoonsful of common salt per gallon of water; if the weather is cold keep the temperature at about 70°F. A daily change of the saline solution is helpful but not essential; a few days of this treatment will usually effect a cure.

There are no special seasonal characters, but the sexes are easily determined at any time. The male is half as deep again as the female, with long, speckled, orange-tinted dorsal and anal fins, extending to and touching the tail, and with a shot-silk color effect of blue, green and bronze on the body. The female has comparatively short, colorless fins and the body not nearly as brilliant, although her silvery blue coloration is quite striking.

A pair was selected from a number in an aquarium and placed in an outside pond, which contained about 400 gallons, in September. About the beginning of November it was found necessary to empty this and the female Pink-ear was caught. As her abdomen was swollen and the former dark inner color had been replaced by white, I concluded that her ovaries were ripening. She was placed again with the others in the tank and another female put in the pond in her place. With the advent of warm weather the ripe female was placed in another freshly planted aquarium in company with a male, new water was added and a quantity of *Fontinalis gracilis* was dropped in for them to spawn on. I might say that as the *Melanotaenia nigrans* are very rarely on the bottom, I considered that they spawned in mid-water, so gave them dense weed accordingly. In four days small whitish globules were seen adhering to the plants, but the appearance of a shoal of fry was the first knowelge I had that the fish had spawned; the whitish globules were unfertilized eggs. The examples in the pond also spawned and as some hundreds of the eggs hatched there, and the young thrived well, I took little or no trouble with those hatched in the aquarium. When very young, dozens of the Pink-ear were seen swimming very close to the surface; they were about 3/16 inch in length, greenish-black in color, and remarkably active for so small a creature. As they became older and bigger they went into deeper water and were only seen when near the warm surface water. There were several spawnings and I found some of the spawn attached to the roots of the water hyacinth. The eggs are about 1/16 inch in diameter.

When placed in the pond the brilliance of the adults is not apparent, excepting when one of them darts to the surface to secure an insect that has fallen in or alighted for a second; with

their speed and alertness they are adepts at obtaining food in this manner. It is very interesting to note that before any fry were about I often heard them splashing as they dashed to the surface to procure a dainty morsel, but when the young ones were present I could not coax them to take a struggling fly from the surface. Even a worm was gently tasted before being eaten, which further goes to show that the adults instinctively refrain from devouring the young.

In mating, the male swims around the female with all his fins expanded making repeated sideways motions or "nods" in the direction of the female. The species spawns in spring and at any time during the summer months. There is no parental care of either eggs or young and the fry feed upon infusoria.

CARASSIOPS KLUNZINGERI (Ogilby).

This little Gudgeon occurs in the western streams of New South Wales and in the River Murray system. In New South Wales it is known as the "Western Carp Gudgeon." The species is exceedingly common near the banks of the River Murray in South Australia, and is found in numbers amongst the densely growing *Potamogeton crispus*. Swimming actions, method of feeding and character of water preferred, are much as in *Mogurnda adspersa*, although the species is common in the cloudy waters of the main stream of the River Murray. Individuals infested with parasitic worms, which form tiny cysts under the skin, are not uncommon, the affected fish appearing as if dotted with small bubbles.

In aquaria the fish cannot stand the water below 55°F., especially for prolonged periods, the cold causing them to act temporarily as if they had some respiratory trouble, or suddenly become partially suffocated. The attacks last only a few seconds, but nevertheless cause consternation to the aquarist; artificial heating will overcome the trouble.

Although susceptible to cold, it is not usual for the fish to contract *Saprolegnia* as do other of our native fishes when confined to aquaria in winter; still it is not immune from this fungus, which sometimes appears on the fins, especially the caudal, after transportation of the fish. No doubt the temperature of the water in our rivers drops to the vicinity of 50° F. in winter but the fish probably lies more or less dormant in the mud during this period. This little gudgeon is, in some respects, a more suitable inmate for aquaria than either *Mogurnda adspersa* or *Philipnodon grandiceps*, being much smaller than the first-named, and not so sluggish in movements as the last. It is almost always

on the move searching for food, while the males struggle for supremacy or skirmish for a secluded place, and endeavour to entice every passing female inside their selected nooks.

The food consists mainly of any small live aquatic animal such as *Daphnia,* mosquito larvae, or small chopped earthworms, which are taken eagerly at any time. I have not as yet succeeded in persuading the species to acquire a taste for scraped meat, it being tasted and then rejected.

The species varies in size, shape and colour; with two adult females one may have a greenish yellow body, and another of the same size (about 1½ inch.), taken from a different locality, a beautiful iridescent colouration. The mature males usually have pink dorsal and anal fins, which deepen to red towards the breeding season, and also faintly defined vertical black markings on the body, most noticeable in the immature specimens. One adult male in my collection has neither of these distinctions, only the blunt head and male-like actions making the sex apparent.

During a trip to Mannum on 13th November, 1927, I collected about 20 examples from amongst *Potamogeton.* They were fed on mosquito larvae and on this diet grew and fattened wonderfully well, several of the females becoming ripe early in February, 1928. At this time I noticed a male trying to entice a female to a secluded corner of the aquarium. On February 24th I transferred a pair to a freshly planted 8 gallon tank containing new water. Three days later the female spawned, this pair did not make use of the stones which were arranged for them, but chose a side of the tank about 2 inches from the surface of the water. The ova are only about half the size of those of *Mogurnda adspersa,* but otherwise are very similar, being elongate and arranged closely together. The male guarded and aerated the eggs in the same manner as described for *Mogurnda adspersa.* On the third day after spawning the eggs disappeared, apparently eaten by the parents. The tank in which these fish were installed was in such a position that I had to reach over it to feed fish in tanks higher up, and on each occasion the male would leave the eggs, returning again after a while. Probably he considered the site he had chosen not private enough, and relinquished his charge. Further attempts to induce them to spawn during the late summer were futile.

Gale (4) records the breeding habits of the Fire-tailed Gudgeon (*Carassiops galli,* Ogilby), a southern Queensland species which became introduced into the Botanic Gardens, Sydney, and in this form also the male cares for the eggs in the same way.

(4) Gale, Aquarian Nature Studies, 1915, p. 20.

FURTHER NOTES ON ABORIGINAL ROCK CARVINGS IN SOUTH AUSTRALIA.

(Contribution from the South Australian Museum).
By Herbert M. Hale, Curator, and Norman B. Tindale, Ethnologist.

(Plate 1, and text fig. 1.)

During the last few years a number of papers have been published describing aboriginal rock carvings in South Australia. Incised patterns or "intaglios" in the Flinders Ranges and the vicinity have in particular attracted considerable attention. We therefore deem it advisable to furnish a few further notes and records which have lately come to our notice in the hope that further research in the areas mentioned will be stimulated. There is evidence to show that aboriginal carvings are quite numerous in South Australia, and it is desirable to have complete records and descriptions of all series.

PANARAMITEE.

Basedow (1) figures a design from Deception Creek which is strongly suggestive of a platypus; it seems that this animal does not now occur in the Interior, or at most, is exceedingly rare there. We have now to record a somewhat analogous example, namely a carving a yard or more in length, which appears to be a representation of the head of a crocodile. The intaglios amongst which this design occurs are situated about 200 yards from Panaramitee Creek, on a saltbush plain some three miles north of Panaramitee station. We are indebted to Mr. C. A. Bartlett for the accompanying photograph of this figure (pl. 1, fig. 1.) The locality is approximately 175 miles south-east from Wilpena Pound and is on the range of the Maraura tribe; it is perhaps significant that a fabled creature likened to a serpent or crocodile features in an old native legend which is quoted by C. H. Harris (2) in an account of Wilpena. He writes:—

"The following story, gleaned long ago from some members of the Woolundunga and Kokatha tribes, is supposed to have reference to this locality. It must be understood by the reader that both sun and moon are believed to return from west to east by various underground passages, sleeping as they go; but the moon takes shorter journeys than the sun, setting wherever it can find a convenient place for the purpose, and is suspected of a good deal of 'artful dodging.' For instance, when too near the sun to be comfortable it makes a short journey and

(1) Basedow, Journ, Roy. Anthrop. Inst., xliv, 1914, p. 205, pl. V,b.

(2) Harris, Public Service Review, x, 1903, p.p. 21-22.

Plate 1.

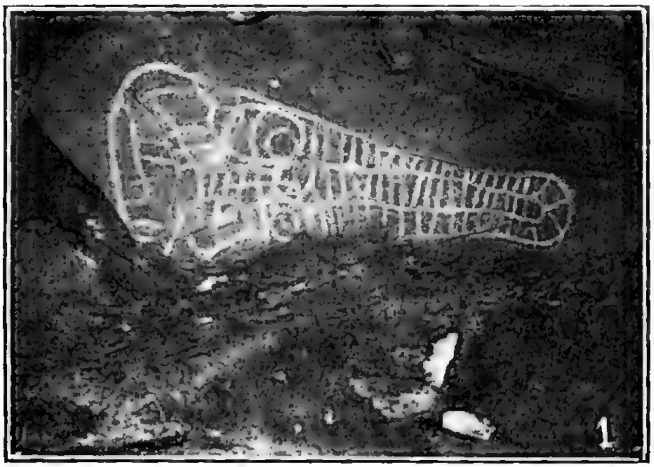

Fig. 1. Aboriginal rock carvings of crocodile head, Panaramitee.

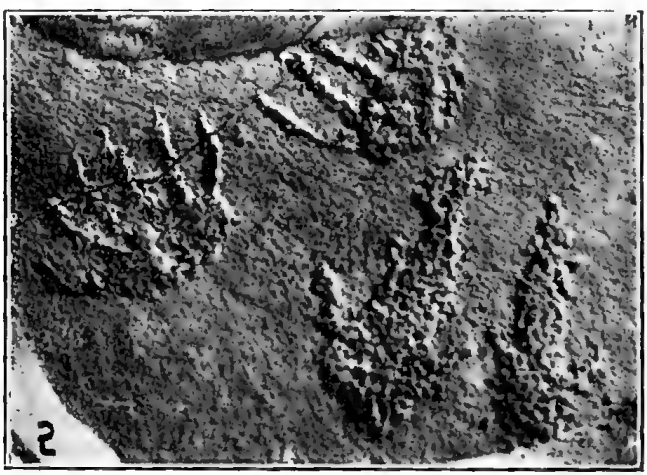

Fig. 2. Aboriginal rock carvings of kangaroo tracks, near Leigh Creek.

gets up in front of the sun next day, or a good way behind, as the case may be.

"One night the moon (Mickacacka) stopped to rest on a high hill (yoontitchie), and being a thirsty soul was attracted by some water near, so slid down the hill to get a drink, thereby scraping off a good deal of kopi [pipeclay] and mica, which with loose stones filled up the water-hole. A fabled creature (serpent or crocodile) named Kaddi-kra, probably one of the Kaddi-murka from Cooper's Creek, tried to seize it, but Mickacacka avoided capture by going under then and there, and was seen no more that night.

"This Kaddi-kra had ravaged the country for several generations, during which he had devoured every living thing that came his way, and had now secured the aid of the great sorcerer Kuditya and other bad spirits (Pokerbie, Koochie, Dlarbie, and Mooljewank) to entice the moon down to him; but Muldarbie, the strongest of the many evil powers that molest a harmless people, came upon the scene with boomerangs of fire, and 'big one grumble, grumble'. He forced Kaddi kra to go underground as the moon had done, and piled earth and rocks over him. The site of this occurrence is alleged to be Wilpena (the place of bent fingers) and the circumstance explains why the aborigines from the Murray to Fowler's Bay fear Muldarbie more than any other spirit. Kaddi-kra, however, is still alive, burrowing his way westward in hope of finding the moon."

"Many a dusky warrior now departed chanted with the greatest glee the following exultant stanza:

"Gar, gardi, gundigar,
Kaddi-kra koodigar kuntigar
Gar gar",

which he repeated to his admiring audience over and over again, with changing inflection and varying rapidity of utterance. The sentiment expressed had reference to Kaddi-kra's progress and unfortunate prospects, somewhat as follows:

"Aha! on the track is Kaddikra.
Aha! he comes not back our lives to mar,
Aha!"

Many times since the occupation of the country by white men rumbling sounds have been heard between Lake Torrens and Flinders Range. These are really earth tremors, but give support in the aboriginal mind to the superstition that some powerful monster is burrowing underground."

If we accept the large carving at Panaramitee as being a

representation of a crocodile head (and it certainly appears to be such) some interesting questions are involved; as abovementioned the statement that the legendary Kaddi-kra was said to resemble a serpent or *crocodile* is also suggestive. It is difficult to understand how knowledge of the form and characteristics of the crocodile could permeate to the Interior, and one is led to the assumption that these Flinders Range natives were at some past period familiar with the reptile.

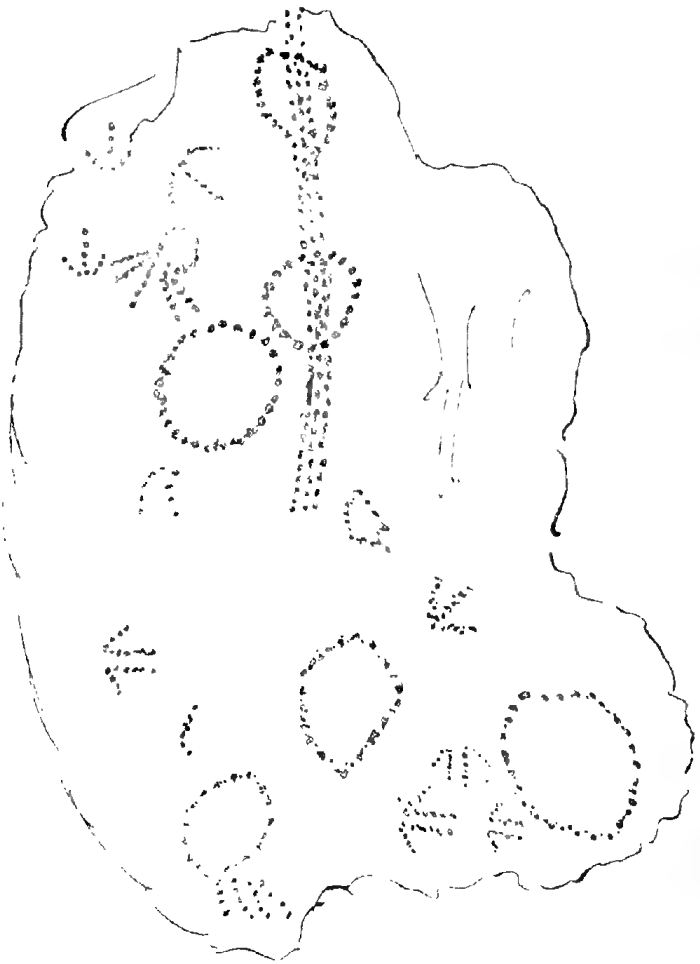

Fig. 1.
Rough Sketch of Aboriginal work on Rocks near Mannahill.

(3) Hale and Tindale, Rec. S. Aust. Mus., iii, 1925, p. 52.

MANNAHILL.

Previously we noted (3) that Mr. E. G. Waterhouse sent a description and specimen of intaglios from Mannahill to the Museum in 1902. We have now seen a letter written by his brother, Mr. S. A. Waterhouse, dated June 5th, 1903, and enclosing a sketch of some carvings in this locality. (text fig. 1.). Mr. S. A. Waterhouse writes "I enclose a small sketch showing aboriginal tattoo work, or in other words a native map. . . . We [E. G. and S. A. Waterhouse] have recently discovered quite an Art Gallery of this work and by all appearance some of the tattoos must be of very ancient date, and there are many other symbols and characters imprinted in the stone including men and animals; the carvings only occur on rocks of very smooth and polished surface. . . . The scene of operations is on the side of a low hill within 3 miles from Mannahill Railway station."

LEIGH CREEK.

In his 1914 paper, quoted above, Basedow states that Mr. J. R. B. Love informed him that he knew of two or three groups of carvings in the vicinity of Leigh Creek, now known as Copley. In 1911 Mr. Love, at the request of the late Sir Edward Stirling, cut out a small portion of one of these groups and sent it to the Museum, with the following note "I have examined these carvings and am sorry to say that as the best executed specimens are on the sides of huge masses of rock which will not split, and which I could not cut with a hack-saw, I know of no way in which they could be removed. I have secured, however, a small piece bearing two dingo tracks and two kangaroo tracks. Though not nearly as well carved as some the specimens—the best groups (three places) are on North Mooloolloo—this piece may still prove interesting as an example, perhaps, of prehistoric work; the present blacks disclaim any knowledge of these carvings."

This piece of clay-slate, which is about a foot in length, is shown in pl. 1, fig. 2; the patterns represent tracks of the hind feet of a kangaroo and, apparently, those of the fore feet of the same animal; it will be noted that each of the two last-named tracks (which Mr. Waterhouse considered are dingo tracks) has six digits. Portion of a further carving, forwarded from the same neighbourhood by Mr. Love a year later consists of the hinder half of a lizard.

YANKANINA, DULKANINNA AND BALCANOONA.

Mr. G. B. J. Roper, who is now living at Second Valley, informs us that there are aboriginal rock carvings of lizards, snakes, emu-tracks, etc., on Yankanina station, 15 miles from Angepina, and also a further series at Dulkaninna, 50-60 miles north-east of Marree.

In our aforementioned paper (3) we quoted Mr. E. G. Waterhouse's description (*in litt.*) of heaps of stones at Outalpa. Mr. Waterhouse recently gave us the additional information that on the open plain at Balcanoona Station, 40 miles or so west of Lake Frome, there are artificial mounds of stones, which, according to the aborigines of the district, were placed there by their people to act as hiding places or screens when kangaroo-hunting.

LECTURES AND EXCURSIONS.

NOVEMBER 24th, 1928.—BRIDGEWATER.

The leader, Mr. E. H. Ising, explained the character of the flora growing in the quartzite soil of this district and pointed out various species of plants of interest.

DREDGING TRIP ON DECEMBER 16, 1928.

A large party ventured aboard the launch but the weather conditions prevented going beyond the breakwater, so that operations were confined to the Harbour and Light's Pass. Interesting hauls were made but no novel forms were secured.

DREDGING TRIP ON FEBRUARY 16, 1929.

A fine number turned out and the weather proved most suitable. The launch went out some distance beyond the spot where the "Norma" wreck still makes a centre for snapper enthusiasts. Many hauls of most interesting material were obtained including varieties of sponge crabs, hermit crabs, and seaweed crabs, sponges of many types, various crustaceans and echinoderms.

The shells of *Lima*, a little bivavle that gets along by vigorously flapping its two shells were found most abundantly as were many forms of tunicates and holothurians.

Mr. W. J. Kimber spoke on the wonderful life histories of many of the forms of life collected making special use of the material to illustrate the many ways in which the various living creatures manage to elude their rapacious enemies.

Mr. E. C. Cole spoke on the preparation and management of aquaria both marine and freshwater. In response to requests the editor promised that some articles dealing with the South Australian forms of Echinoderms would appear in the Naturalist at an early date.

LECTURE BY Dr. A. E. V. RICHARDSON—"NATURE NOTES FROM ABROAD", ON SEPTEMBER 18, 1928.

The lecturer gave a most informative talk on the methods adopted in growing rice and other crops in Japan, Java, and other countries which he had personally investigated. A large number of excellent views including garden scenes and tropical scenery, contributed to the interest of the lecture.

LECTURE BY PROF. J. B. CLELAND, M.D.—"THE ORIGINAL FLORA OF THE ADELAIDE PLAINS," ON OCTOBER 16, 1928.

The substance of this lecture has already appeared in the pages of "Naturalist." On the same evening Mr. Ising spoke on some native plants found by him in the railway reserve at Mile End.

Dr. Cleland and Mr. Ising gave a brief account of the work of the Herbarium Committee and Mr. Ising read a paper on the work of the Committee and its use in regard to the Botanical study of this State.

Exhibits were tabled by several members. Dr. Cleland showed a specimen of the Water Mallee (*Eucalyptus oleosa*), Caustic Bush (*Sarcostemma australe*) and Sea-grass (*Cymodocea antarctica*) together with examples of the fibres obtained from *Posidonia australis* of the Gulfs. Mr. A. J. Wiley showed samples of his expert work in turning various native timbers, showing to great advantage the wonderful variety of colour and grain. The Rev. H. A. Gunter showed an albino form of the reddish orchid *Lyperanthus nigricans* from Highbury.

LECTURES.
NOVEMBER 20th, 1928.

The evening was taken up by a series of nature notes by Prof. J. B. Cleland, Messrs. B. B. Beck and E. H. Ising. Prof. Cleland referred to the rare shrub, *Hymenanthera angustifolia* in the Violet family, which he collected on Mt. Remarkable in September, 1927. The previous record of this plant was 45 years earlier in the gorge of the Onkaparinga; Mr. J. M. Black also collected it near the Torrens Valley Road in 1927 and Mr. E. H. Ising collected it in the Alligator Creek, near Wilmington in October, 1928. Prf. Cleland also referred to several species of native pine, *Callitris*, and suggested that *C. glauca,* (a conical shaped tree) grows at Wilpena and Alligator Creek, *C. propinqua* at the Pinery near Grange, and that *C. robusta* is a West Australian plant.

Prof. Cleland visited Whyalla, Euro Bluff, lower end of Lake Torrens, thence eastwards across the railway line and then to Port Augusta, and during the trip made a special study of the trees being pulled for sandalwood which is being sent to China. He found that the fragrant sandalwood, *Fusanus spicatus*, is the tree used commercially and it was observed at Whyalla, Iron Knob, Nonning, Hawker, Kingoonya and Tarcoola. It is a straggly tree of about 10 feet in height and is root parasitic on other plants. From Nonning a specimen of the wood fruits and leaves was shown; the nut is slightly pitted, almost smooth.

For comparison the two other S. A. species were mentioned as follows:—The bitter quandong (*F. persicarius*) the nuts of which are distinctly pitted but not nearly so deeply as those of the native peach; sweet quandong or native peach, (*F. acuminatus*) the nuts of which are deeply pitted and the fruit is edible. In the field these three species are easily distinguishable. Another tree growing in the same class of country as the above is also called sandalwood but belongs to a very different family (*Myoporaceae*) and is named *Myoporum platycarpum;* this is not used for joss sticks. Prof. Cleland also exhibited some rare sea urchins he collected on the beach at Aldinga Bay; these had short spines and appeared to be a different species to the one usually found on our beaches having long spines. Mr. B. B. Beck gave an interesting description, aided by a number of photos, of the Alligator Creek, near Wilmington. The creek formed a deep gorge which, for its height, sheer precipices hundreds of feet down, its rugged grandeur and altogether unique scenery, is unsurpassed in South Australia. Its difficulty of access and long walk to reach it has prevented it from being known except to a few venturesome naturalists and others. Mr. E. H. Ising spoke on the botany of this creek and the surrounding country, including Mt. Remarkable. Mr. W. Ham exhibited a number of mineral specimens from near Kingscote, K.I., including archaeocyathinae, blue slates with fossils, basalt, fossil echinoides and barytes.

THE "SANDALWOOD" OF S.A. AND W.A.

Note on the Genus *Eucarya* (*Fusanus*), Nat. Ord. Santalaceae.

In the Kew Bulletin, 1927 (p. 195) Messrs. Sprague and Summerhayes discuss the naming of the genus *Fusanus* and, after sifting a lot of evidence, come to the conclusion that this name cannot stand and substitute T. L. Mitchell's name of *Eucarya* in its place. Bentham (1) treated the latter name as a synonym of *Fusanus*. Our species therefore are now as follows:—

1. The Native Peach or Quandong with edible fruit (*Eucarya acuminata* (R.Br.), Sprag. et Summ.).
2. The bitter Quandong (*E. Murrayana,* Mitchell).
3. The fragrant Sandalwood which is used commercially in this State and also in West Australia (*E. spicata* (R.Br.), Sprag. et Summ.)

(1.) Flora Austral.

E.H.I.

PLEASE NOTE.

A member of the Section is desirous of disposing of a collection of minerals (including rare Broken Hill specimens) and case. Particulars from Mr. B. B. Beck or Mr. W. Ham.

ADDITIONS TO OUR LIBRARY.

1. Exploring the Universe: The Incredible Discoveries of Recent Science. By Henshaw Ward. A well-written account of the problems which Science has undertaken to solve in recent times.
2. The Reptiles and Amphibians of South Australia. By the late Edgar R. Waite, F.L.S., C.M.Z.S. Edited by Herbert M. Hale, Curator, S.A. Museum. Deals with the Turtles, Crocodiles, Lizards, Snakes, Frogs, and Toads of our State, and contains an appendix on the treatment of snake-bite. Interestingly written and profusely illustrated, this volume contains an immense amount of accurate information regarding the reptiles and amphibians of our State,, form of life about which the man in the street has usually very vague and largely incorrect ideas.

The South Australian Naturalist

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EXCURSIONS.

June 15—Museum. Entrance, 2.30 p.m. General. President.
29—Morialta. Tram, 2 p.m. Botany. Prof. J. B. Cleland.
July 13—Semaphore (north). Train, 2.05 p.m. Shore Life. Shell Club.
27—Highbury. Paradise Tram, 2 p.m. Orchids, etc. Rev. H. A. Gunter.
Aug. 10—Belair, National Park. Train, 2.20 p.m. Orchids. Dr. R. S. Rogers, M.A.
24—Kingston Park Reserve. Seacliff Train, 2.06 p.m. Native Flora. Mr. J. A. Hogan.
Sept. 7—Paradise, Mr. J. H. Coulls'. Charabanc. General. Mr. J. Kimber.

LECTURES AND EVENING MEETINGS.

*June 18—"Flinders Ranges and Further Inland," by Rev. A. M. Trengrove.
*July 16—"Some Critical Aspects of Australian Anthropology," by Dr. H. Basedow, M.P.
Aug. 20—Annual Meeting and Exhibits.
*Sept. 17—"The Stellar Universe," by Prof. R. W. Chapman, C.M.G., M.A., B.C.E., F.R.A.S.
Oct. 15—Exhibit Evening.—Mr. A. M. Lea, F.E.S., "Some New Guinea Insects," 2. Mr. J. G. Wood, "Wallace's Line." 3. Mr. W. Ham, "Sea Urchins."
Nov. 19—Exhibit Evening:—1. Mr. E. A. S. Thomas, "Native Timbers"; 2. Mr. E. H. Ising, "The Heath Family of Plants." 3. Mr. W. J. Hosking.

*These Lectures will be given with Lantern Slides in the Lecture Room.

The South Australian Naturalist.

VOL. X. MAY, 1929. No. 3.

PLANTS OF THE ENCOUNTER BAY DISTRICT.

Second List of Additional Records.

By J. B. Cleland and J. M. Black.

We published our first list of the vascular plants of the Encounter Bay district in the "South Australian Naturalist" for February—May, 1925, and a list of additions in May, 1927. Since then further search and revision have enabled us to add 58 more species and 1 variety, 42 of the species and the 1 variety being native plants, and 16 introduced. One variety in the old list has been raised to specific rank. The total number of vascular plants now known for the district is approximately 732 (excluding 12 varieties) of which 588 are native and 144 are introduced species. In our last paper we suggested that fifty or more, chiefly introduced or ephemeral spring species, doubtless remained to be recorded. The number in this paper is 58, and we must expect 20 or so more still awaiting discovery. It is interesting to note that this close survey has resulted in discovering two species (in Cyperaceae and Restionaceae respectively) new to science; in finding *Zostera Muelleri* in flower in the Hindmarsh River, the first time we believe that a *Zostera* has been found flowering in this State; in discovering on the Waitpinga road, just before the house of Mr. Dennis is reached, a patch of *Gahnia ancistrophylla*, a Western Australian Cyperaceous plant; and in finding the rare *Leucopogon Clelandii* in this district, only the third occasion on which it has been seen. In addition, we include in the paper certain corrections, some alterations in nomenclature, some additional localities for rare species, and a few notes.

FILICALES.—Ophioglossum coriaceum, A. Cunn., Adder's Tongue, flats at Encounter Bay.

LYCOPODIACEAE.—Phylloglossum Drummondii, Kunze, additional locality, near Hall's Creek, Sep.

POTAMOGETONACEAE.—Zostera Muelleri Irmisch, in flower, Hindmarsh R. estuary, Jan., 1928; *Potamogeton pectinatus*, L., Waitpinga Creek, Jan.

SCHEUCHZERIACEAE.—Triglochin centrocarpa, Hook., flats and hills at Encounter Bay, Aug., Sep.

HYDROCHARITACEAE.—Halophila ovalis (R. Br.) Hook. f., one leaf washed ashore at Encounter Bay, May.

*GRAMINEAE.—*Ehrharta longiflora,* Sm., Hindmarsh Valley (one plant). A series of specimens of *Stipa* from Encounter Bay and other S. Australian localities was recently submitted by one of us to Kew. The Director, in reporting on these, has furnished the following identifications of species from this district:—*Stipa tenuiglumis,* Hughes, Jan.; *S. eremophila.* Reader—rather young, it has the floret of *S. eremophila* rather than of *S. fusca;* S. *variabilis,* Hughes, Encounter Bay, Sep., also on limestone, Pt. Elliot, Jan., with the added note, "the leaves are rather more rigid and rougher than usual;" S. *falcata,* Hughes, Aug., Sep. **Aira minuta,* L., seems to flower earlier than *A. caryophyllea;* **Hordeum maritimum,* With.

CYPERACEAE.—Schoenus Tepperi, F.v.M., common as a dense sward on stony hills, etc.; *S. monocarpus,* J. M. Black (Trs. Roy. Socy., S.A., LII., 1928), a new species found at Back Valley; *Gahnia lanigera* (R.Br.), Benth., in low patches, smaller than *G. deusta; Cladium Mariscus* (*L.*) Pohl., already recorded, has been found also on a branch of Waitpinga Creek; *Gahnia ancistrophylla,* F.v.M., hitherto only known from West Australia.

RESTIONACEAE.—Lepyrodia valliculae, J. M. Black (Trs. Roy. Soc., S.A., LII., 1928), a new species found at Back Valley.

*LILIACEAE.—*Allium? sp.,* a small onion or leek has established itself as a small colony of a dozen or so individuals on the banks of the Inman, near the bridge. These have been present now for several years. A single plant of **Asparagus asparagoides,* Wight, the 'Smilax' of florists, a garden escape, was found in the scrub 8 miles along the Inman Road, far from habitations.

ORCHIDACEAE.—Cryptostylis longifolia, R.Br., already recorded, has been found in a swamp at Back Valley, Jan.

CASUARINACEAE.—In the old cemetery on the ridge road, Bald Hills, are several very large She-oaks (*Casuarina stricta,* Ait.). Though forking near the base, the larger of the two stems of one was about 34 inches in diameter at breast height. Miss Macklin (Trs. Roy. Soc., S.A., LI., 1927), has identified four species of the dwarf '*C. distyla*' complex in the Encounter Bay district, viz., *C. striata,* Macklin, upright, twiggy, with cones near the ends of the branches, 2 to 15 ft. high; *C. Muelleriana,* Miq., more rounded, often with a reddish tinge, cones rather large, greenish brown; *C. paludosa,* Sieb., var. *robusta,* Macklin,

lower plant, anthers rusty; and *C. pusilla,* Macklin, low cushion-like plant in sand, anthers rusty.

LORANTHACEAE.—Loranthus Preissii, Miq., previously recorded for just outside the district (Hay's Flat) has been seen on a planted *Acacia* (probably *A. dodonaeifolia*) in the Inman Valley, near Bald Hills; *L. pendulus,* Sieb., two to four flowers in the umbel, sometimes two sessile, grows on stringy bark (*Eucalyptus Baxteri*) on the ridge road at Bald Hills.

*AIZOACEAE.—*Mesembrianthemum aurantiacum,* Haw., a garden escape, has formed a colony near the Public Hospital site.

PORTULACACEAE.—Calandrinia pygmaea, F.v.M., Sep.

*CARYOPHYLLACEAE.—*Moenchia erecta* (L.) Gaertn.—Mey-et Scherb., on hills, Sep.; **Minuartia tenuifolia* (L.) Hiern., on hills, Sep.; **Silene nocturna,* L., sandhills.

RANUNCULACEAE.—Ranunculus parviflorus, L., hills, Aug.

CRUCIFERAE.—Cardamine hirsuta, L., Sep.; **Draba verna,* L., Sep.

CRASSULACEAE.—Crassula colorata (Nees), Ostenf. Sep.; *C. macrantha* (Hook. f.), Diels et Pritzel, Sep.; C. *pedicellosa* (F.v.M.), Ostenf., Bluff.

*ROSACEAE.—*Alchemilla arvensis,* Scop., hills, Sep.

LEGUMINOSAE.—Acacia farinosa, Lindl., semi-swamp ground north-west of the Bluff; *A. calamifolia,* Sweet, in the cemetery at Encounter Bay; a blackwood (*Acacia melanoxylon,* R. Br. ..) at Hall's Creek has a trunk 27 ins. in diameter; *Daviesia* sp. (not in flower) near *D. divaricata,* Benth., Newland's Head; **Trifolium arvense, L.;* Melilotus alba,* Destr., Bokhara Clover,

RHAMNACEAE.—Cryptandra tomentosa, Lindl.

DILLENIACEAE.—Hibbertia sericea (R. Br.) should be var, *scabrifolia,* J. M. Black; *H. stricta,* R. Br. (var. *glabriuscula,* Benth., already recorded), Inman Valley hills.

GUTTIFERAE.—Hypericum gramineum, Forst, f., instead of *H. japonicum,* Thunb., already rceorded.

VIOLACEAE.—Viola Sieberiana, Spreng., near Hall's Creek, Sep.

THYMELAEACEAE.—Pimelea spathulata, Labill., near Hindmarsh Tiers.

MYRTACEAE.—Melaleuca pubescens, Schau., replaces *M. parviflora,* Lindli., already recorded; *M. fasciculiflora,* Benth., in scrub round the edge of swampy land towards Newland's Head (recorded for the district in Black's Flora).

UMBELLIFERAE.—Hydrocotyle pilifera, Turcz., near Hall's Creek, Sep., previously recorded in this State from between

Marree and Strangways Springs, and from Muloowurtie, Y.P.; *Eryngium vesiculosum*, Labill., previously recorded by us for Hindmarsh Tiers, is common on the ridge road, Bald Hills. The plants cannot stand grazing, and so have only survived on the roadside, not in the fields. Though prickly and very like a star-thistle, *E. vesiculosum* forms a very pretty table decoration with its deep blue globular heads of flowers.

EPACRIDACEAE.—Leucopogon Clelandii, Cheel, in flower in a dry swamp north-west of the Bluff, May (previously only known from Coonalpyn and Kangaroo Island); *Acrotriche affinis* DC., in the same locality (previously known in this State only from Coonalpyn and Beachport).

LOGANIACEAE.—Logania recurva, J. M. Black, on the Waitpinga-Bald Hills Road; *L. crassifolia*, R. Br., var. *minor*, J. M. Black, Pt. Elliot, previously recorded as a form of *L. ovata*.

LABIATAE.—Prostanthera aspalathoides, A. Cunn., is recorded in Black's Flora for Encounter Bay; *P. serpyllifolia* (R. Br.) Briq. replaces *P. microphylla; P. chlorantha*, F.v.M., Newland's Head scrub.

SCROPHULARIACEAE.—Veronica Derwentia, Andr., waterfall, off Inman Valley.

RUBIACEAE.—Opercularia turpis, F.v.M., in Black's Flora for Encounter Bay; *Galium ciliare*, Hook, f., on cliffs at Newland's Head; *Opercularia ovata*, Hook, f., already recorded, also in the old cemetery at Bald Hills.

*CUCURBITACEAE.—*Citrullus vulgaris*, Schrad., wild pie-melon.

GOODENIACEAE.—Goodenia primulacea, Sch., instead of *G. geniculata*, R. Br.; *Scaevola calendulacea* (Andr.), Druce instead of *S. suaveolens*, R. Br.; *S. linearis*, R. Br. is var. *confertifolia*, J. M. Black; *Dampiera lavandulacea*, Lindl., is present, and probably it is to this species that the record of *D. rosmarinifolia*, Schl., applies.

STYLIDIACEAE.—Levenhookia dubia, Sond., replaces *L. Sonderi*, F.v.M.; *L. pusilla*, R. Br.

COMPOSITAE.—Olearia grandiflora, Hook., hills near Hindmarsh Tiers; *O. revoluta*, F.v.M. var. *minor*, Benth., Tunkalilla, Jan.; *Brachycome lissocarpa*, Black; *Cassinia complanata*, Black; *Isoetopsis graminifolia*, Turcz., hills; *Podosperma angustifolium*, Lab.; *Carduus tenuiflorus*, Curtis, slender thistle, off Inman Valley; **Cirsium Acarna* (L.), Moench, Soldier Thistle, recorded in Black's Flora for "towards Pt. Elliot;" *Vittadinia tenuissima* (Benth.) Black replaces *V. australis* var. *tenuissima* already recorded

SOUTH AUSTRALIAN TREES.

No. 7. Cabbage or Scrub Gum (*Eucalyptus cosmophylla*, F.v.M.)

By Ernest H. Ising.

I. GENERAL.

This species has, so far, only been found in South Australia and it was Mueller who discovered it (1) in 1855 somewhere in the Mount Lofty Range. Unfortunately Mueller did not give any precise locality, which is so desirous in a type specimen. The name "Scrub Gum" has no doubt originated from the shrubby nature of the plant as it is usually seen as a small, crooked tree or shrub. In this it approaches the mallee type and there are often several stems growing together, although it is not known if they arise from the same root-stock. Occasionally specimens have been recorded growing into fair size trees and Maiden (2) mentions one of 50 feet in height seen at Kuitpo by Mr. Walter Gill.

II. BOTANICAL.

Eucalyptus cosmophylla, F.v.M. The name "cosmophylla" means regular-leaved and refers to the two equal halves of the base of the leaf.

HABIT.—Usually shrubby, often a small crooked tree of 12 to 15 feet in height, sometimes higher.

BARK.—The trunk has a smooth bark which is of a flaky nature, i.e. it decorticates in small flakes or patches about the size of one's hand. This species falls into the bark group "*Leiophloiae*" (smooth barks or gums) of Maiden who describes the bark (3) as follows:—"A smooth-barked tree, the exfoliating bark coming off in irregular patches, never hanging in strips." The bark is of a pale grey colour, and is perhaps coarser at the base, the higher part of the stem and branches are smoother and whiter.

LEAVES, Sucker*. In shape they vary from almost circular, sometimes broader than long, to oval and in size they also vary considerably. From about half an inch they obtain a length of over 2½ inches by 2 inches in width. A few of the first leaves are opposite but they soon become alternate, they are dull green with the lower surface paler; the intramarginal vein is situated from one-sixteenth to one-eighth of an inch from the edge. The point is always blunt, in the lower leaves it is apiculate and then gradually becomes less obtuse as the later leaves develop.

* The leaves described here are those growing from the lower branches after the plant died off at the top.

MATURE LEAVES. Ovate to lanceolate, falcate, and 4 to 7 inches in length, the longer ones acuminate and often hooked. Surfaces equally green and somewhat shiny. Intramarginal vein hardly one-eighth of an inch from the edge and the bases of the leaf usually very regular. Texture leathery and therefore stiff.

THE BUDS. The buds are large being ¾ of an inch long and three-eighths of an inch wide, the tube somewhat longer than the cap which is produced into a short blunt point; they are almost top-shaped except that the lid is more pointed. They are usually arranged in threes, the centre one only with a very short stalk and have hardly any common stalk to the umbel.

THE FLOWERS. The flowers are large, white with anthers oblong, opening in parallel slits. When fully expanded the flowers exceed an inch in diameter.

THE FRUIT. Hemispherical in shape with a broad base and truncate at top. The valves (4 to 5) are somewhat sunk below the raised rim. Occasionally there are one or two ridges down the side but they are not prominent. The fruits range from half to three quarters of an inch long and the same in width.

III. GEOLOGICAL

The trees growing at Waterfall Gully are situated on the steep sides of the gullies chiefly in the higher situations where the sandstone comes to the surface and lies about in broken fragments. This habitat would be a dry one as the sandstone is of a porous nature and the rainfall would quickly disappear in the rocky soil. The Mount Lofty Range habitat is referred to by J. E. Brown (5) who mentions this species as growing on coarse-grained siliceous grits. At Victor Harbour he quotes it growing in low-lying moist situations, sandy soil, and on Kangaroo Island in hollows and round edges of lagoons and claypans.

The type of soil as observed by Teale (6) at Kuitpo is given as "yellowish, gravelly, clay loam found on table top areas from soils derived from quartz schists, quartz mica and chloritic schists, felspathic schists of Pre Cambrian Age."

According to Adamson and Osborn (7) this species is best developed on fine ironstone soils derived from a solid, rather fine-grained ironstone rock and it occurs for the most part on the relatively level ground on the tops of ridges but can also maintain itself on steep slopes; on some of the lower flat-topped ridges and watersheds the solid ironstone may be some distance below the surface and be overlain by 2-3 feet of a soil of a loamy consistency which is very retentive of water in winter but becomes baked very hard and dry in the summer. Further this species is not confined to these hard ironstones but also occurs on por-

tions of ridges where the rock is a hard crystalline quartzite which weathers slowly to a shallow, rather compact soil; it is also occasionally found on the quartzitic ironstone gravels where the rock itself is impregnated with iron and where the soil is shallow and sandy.

Near Aldgate this species occurs in a small depression where the soil is deeper and of a loamy character although in the higher parts it is of a more sandy nature derived from the fairly abundant sandstone rocks. To the south-west of Aldgate it is also found in lowlying ground where the soil is deep and of a sandy-loam which would retain moisture even during the summer. This species appears to thrive on soils whose surfaces are totally different in appearance but whose composition or texture appears to be the same.

IV. ASSOCIATIONS.

This species is chiefly found as an associate of the stringybark forests which inhabit the higher parts of the Mount Lofty Range. It forms communities which can be traced to a definite soil type.

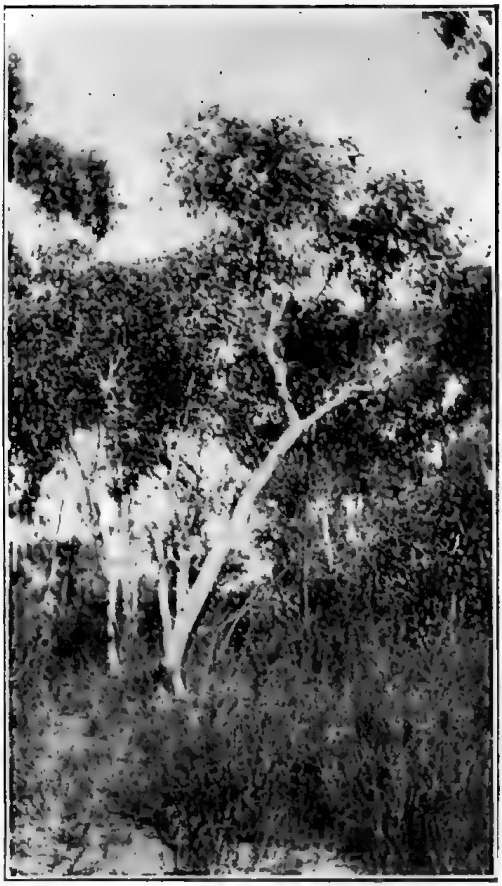
No. 1. Stirling East to Aldgate. Between Stirling East and Aldgate there is some flat ground at the foot of a steep hill where the scrub gum grows somewhat plentifully. The soil is fine-grained sandy loam and there would be a fair amount of moisture in the soil at the end of the winter. The specimens growing here are small trees of about 12 feet in height and of crooked, stunted growth generally. Associated here with the scrub gum was the white stringybark (*Euc. obliqua*) which was almost as abundant as the former, there were also several small trees of the yellow gum (*E. leucoxylon*). The largest shrubs here were *Hakea ulicina* and the teatree (*Leptospermum scoparium*) growing as high as eight feet and others somewhat smaller were blunt-leaved tea-tree (*L. myrsinoides*) and fringe myrtle (*Calythrix tetragona*). The vegetation type here is of a sclerophyllous nature, the larger plants not mentioned above are mostly included in the families *Proteaceae, Leguminosae, Epacridaceae,* and *Dilleniaceae*. Smaller plants consist of legumes, composites, rushes, lilies, goodenias and orchids. The plants in flower (30/1/28) were *Lobelia gibbosa, Trachymene heterophylla, Ixodia achilleoides, Wahlenbergia gracilis, Dichopogon strictus* and *Helichrysum scorpioides*.

No. 2. Aldgate to Bridgewater. About half a mile from Aldgate on the road to Bridgewater on a slope facing south the scrub gum is again associated with the white stringybark in dense scrub. This slope extends for several hundred yards and

there is a depression in the centre of it with a small creekway. On the steeper slopes the most abundant shrubs are the two tea-trees (*L. scoparium* and *L. myrsinoides*), the large leaf bush-pea (*Pultenaea daphnoides*) and the beaked Hakea (*H. rostrata*); these plants were 5 to 8 feet in height and covered much of the space between the trees. Other prominent shrubs of smaller size were the scrub wattle (*Acacia myrtifolia*), heath (*Epacris impressa*), *Ixodia achilleoides* and a rush, *Lepidosperma semiteres*. Towards the depression the narrow-leaf bitter-pea (*Daviesia corymbosa*) and the furze *Hakea* (*H. ulicina*) appear in numbers and in the lowest part *Leptospermum scoparium* is most abundant to the extent of almost excluding every other species. Swamp plants such as *Patersonia longiscapa, Gahnia psittacorum, Acacia verticillata* and *Villarsia exaltata* were noted in the lowest portion. Only a few specimens of the cabbage gum were growing in the wetter situation, and they did not extend far up the westerly slope of the depression which supports a vegetation similar to the opposite slope. *E. cosmophylla* approaches the ridge on the top of which are only a small number of this species, and associated with it in this habitat is an abundance of *Pultenaea involucrata*, a spreading undershrub with a dense mass of small hairy leaves. The grass tree (*Xanthorrhoea semiplana*)and a rush (*Lepidosperma semiteres*) grow in a fair quantity in this habitat. Aspect, habitat and soil play an important part in plant distribution as on the northerly slope of the ridge under review the chief tree is *E. Baxteri*, the brown stringybark and here the soil is thickly strewn over with all sizes of sandstone rock. Proceeding in a westerly direction the cabbage gum was noticed on little ridges and at the head of gullies and on slopes and growing in scrub similar to that already described.

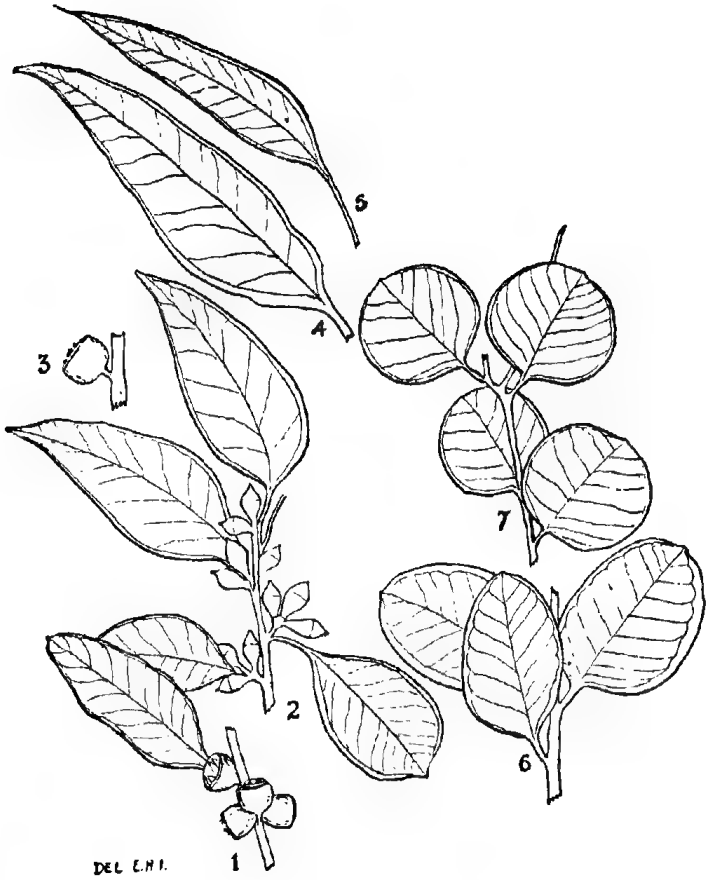
No. 3. Waterfall Gully, near Eagle-on-Hill. The steep slope near and below the main road just beyond the Eagle-on-Hill (at 8¼ miles from Adelaide) has been investigated and a fair amount of *Euc. cosmophylla* is found growing there. A very deep and steep gully leads from Mount Lofty summit in a westerly direction and when Waterfall Gully is approached the northen slope develops a precipitous character, at this point also the gully bends south-west and a good view is obtained of the lower portion of Waterfall Gully. It is at this bend where the cabbage gum has been noted in its ecological relationships. On the northerly slope the cabbage gum is associated with the white and brown stringy-bark and with isolated trees of yellow gum; it is only a small tree and often shrubby in habit. The chief

Plate 2.



The habitat of *Eucalyptus cosmophylla*, with associated plants (on the steeper slopes) as described in No. 2 par. p. 43.

Plate 3.



Drawing showing botanical characters of *Eucalyptus cosmophylla*. 1. Mature fruits. 2. Branch with buds and leaves. 3. Fruit showing the short pedicel. 4 and 5. Mature leaves. 6 and 7. Juvenile leaves.

shrubs here are *Leptospermum myrsinoides* and *Acacia pycnantha, A. myrtifolia* and *Ixodia achilleoides* while *Hibbertia sericea* (silky guinea-flower) is an abundant undershrub. Where a bend in the slope faces east the cabbage gum has *Pultenaea daphnoides, Exocarpus cupressiformis* and *Hakea rostrata* associated with it. A group of this gum was surrounded by the white stringybark, a yellow gum and shrubs as mentioned above in this location with also *Acrotriche serrulata, Astroloma humifusa, Xanthorrhoea semiplana* and *Halorrhagis teucrioides*. Lower down the slope facing north-east, where *E. cosmophylla* still grew plentifully, plants of *Calythrix tetragona, Pultenaea involucrata, Hakea ulicina* and *Eucalyptus Baxteri* were numerous, the yellow gum was also seen here. The soil of this habitat is coarse and sandy with a large quantity of broken sandstone fragments on the surface and just below. This is a cabbage gum-tea-tree association the dominants being *E. cosmophylla* and *Leptospermum myrsinoides* with *Hibbertia sericea* sub-dominant. Still farther down this slope the cabbage gum becomes a small tree. On the southern slope of this ridge at the head of a small gully shrubby specimens of this gum are growing in the shelter of the brown and white stringybark with plants of *Hakea rostrata, Xanthorrhoea semiplana, Hibbertia sericea* and *Dianella revoluta* intermixed with it. On the western slope overlooking Waterfall Gully the cabbage gum is again associated with the brown stringybark and less of the yellow gum, with the usual shrubs of *Leptospermum myrsinoides* in abundance and *Hakea rostrata* and *Calythrix tetragona* in fair quantities.

No. 4. Longwood. At Longwood the cabbage gum is found (in one location) on a western slope near the top of a ridge associated with *E. Baxteri* which is the chief tree. The tea tree (*Leptospermum myrsinoides*) is again the dominant shrub while other less abundant shrubs are *Banksia marginata, Casuarina* sp. a shrub of 6 to 7 feet in height (probably *C. Muelleriana*, Miq.), *Hakea rostrata, Pultenaea acerosa*, var. *acicularis* and smaller plants of *Isopogon ceratophyllus, Pimelea octophylla, Platylobium obtusangulum, Hibbertia spp., Olearia Huegelii* and *Helichrysum Baxteri*. This habitat had no surface stones but it was a dry situation, the soil was whitish to yellowish and of a sandy nature. Some distance from the above locality *E. cosmophylla* was found in a small swampy depression growing as a shrub of about 5 feet in height. Here the tea-tree (*Leptospermum scoparium*) was the dominating shrub of a uniform growth of about three feet in height. *Hakea rugosa* and *Melaleuca gibbosa* were represented by a few shrubs, *Burchardia umbellata* and several rushes were present also two swamp plants of very small size, viz., the green orchid *Microtis atrata* and the minute *Mitrasacme distylis*.

No. 5. West of Crafers. About half a mile west of Crafers a ridge runs in a westerly direction parallel to and on the south side of the main road. The cabbage gum occurs on the higher part (the lower part is still to be investigated) and where it was observed on a slope facing west the soil was of a quartzite character with some surface stone. Here it was associated with trees of *Eucalyptus obliqua, E. leucoxylon* and the native cherry, (*Exocarpus cupressiformis*) and shrubs of *Ixodia achilleoides* were the dominant factor in this stratum and less individual plants of *Pultenaea daphnoides, Hakea rostrata, Acacia myrtifolia,* and a fair quantity of *Hibbertia stricta* (a diffuse undershrub,) while *Lepidosperma semiteres, Tetratheca pilosa, Acrotriche serrulata* and*Dianella revoluta* were the chief plants although not abundant, of the smaller vegetation. The above habitat led into a small gully with a westerly course and was dominated by *E. obliqua* chiefly and by *E. leucoxylon. E. cosmophylla* occurred amongst these trees as scattered, shrubby individuals and where the gully flattened out in one place the cabbage gum and tea-tree (*Leptospermum myrsiniodes*) took charge. A little higher up the gully investigation showed that besides the species mentioned above the following also occurred as infrequent units of the vegetation:—

Bursaria spinosa, Hakea ulicina, Grevillea lavandulacea, Pimelea spathulata and *Leptospermum scoparium* as shrubs and *Lomandra dura, Hibbertia stricta* as host to *Cassytha glabella* and *Juncus pauciflorus* as smaller plants.

V. DISTRIBUTION.

In writing of this species J. E. Brown (l.c.) gives a general distribution "in the Mount Lofty Ranges from Waterfall Gully to the Onkaparinga River, in gullies and foothills of ridges. Always in cool parts—not inland. Between Yankalilla and Victor Harbor, Square Waterhole, Meningie and Coorong, South coast of Kangaroo Island, Marble Range and Port Lincoln."

It is one of the very few species which South Australia can claim as its own as it is confined to this State. It is found in the Mount Lofty Range (in the higher parts chiefly), near Port Lincoln and on Kangaroo Island.

On various excursions by members of our Section the occurrence of *E. cosmophylla* has been recorded in "The South Australian Naturalist" the references are as follows:—

Vol. II, No. 1, p. 8 (1920); at Kuitpo.

Vol. III, No. 4, p. 58 (1922); at Myponga with *E. fasciculosa* (pink gum).

Vol. IV, No. 1, p. 96 (1922); Mt. Bold on ridge tops.
Vol. IV, No. 2, p. 111 (1923); MacGillwray, K.I.
Vol. V, No. 2, p. 100 (1924); Mt. Lofty with mallee habit; l.c. p. 104; Mt. Lofty Range.
Vol. V, No. 4, p. 136 (1924); Gandy's Gully (Mt. Lofty Range) in flower.—24.5.24.
L.c., p. 139; Waterfall Gully—in higher part as a stunted crooked, small tree. 12 to 20 feet in height, in flower.—19.7.24.
Vol. VI, No. 3, p. 48 (1925); very common in Encounter Bay District (J. B. Cleland), mallee-like to small trees, capsules often very large, in sand or sandy loam.
Vol. VII, No. 1, p. 22 (1925); at Finniss.
This species is recorded from Prospect Hill (9) near Mylor.

VI. FORESTRY AND TIMBER.

As *E. cosmophylla* is not a large tree generally the question of forestry and timber hardly need enter the discussion. Nevertheless Mr. Walter Gill, late Conservator of Forests, supplied the late Mr. J. H. Maiden with the following note in this connection (8):—"I took the opportunity of working some of it at Kuitpo, and on morticing the holes for slip-panel rails, found the timber to be quite the easiest cutting gum I have yet come across, as the chisel cuts it readily and the auger bores it with equal facility. So easy does it seem after working other gums such as *E. leucoxylon, E. obliqua* and *E. fasciculosa,* that one almost begins to doubt its value for lasting. And yet I find that people in the districts where it does not grow are in the habit of getting it if they can for stockyard posts, as, combined with its easy working nature, it posses a character for lasting well in the ground."

The timber is red in colour. There is an excellent photograph of a large tree (for this species) taken by Mr. Walter Gill, in the Report of the Woods and Forest Department (11). The tree stands about 40 feet in height and is about 3 feet in diameter at the base. This must be the largest of its kind ever recorded. Mr. Gill also records (12) that the legs of a table exhibited at the Government Tourist Bureau Kiosk at the Outer Harbor were made from this species.

VII. FLORISTIC COMPOSITION.

The 5 columns represent the districts as mentioned under IV, and the letters refer to the occurrence of a species in that district; the references are:—a - abundant; fa - fairly abundant; o - occasional; r - rare.

FLORISTIC COMPOSITION.

Species	1	2	3	4	5
Tree stratum.					
Eucalyptus obliqua	a	a	fa	o	fa
E. leucoxylon	r		o		fa
E. Baxteri			fa	fa	
Exocarpus cupressiformis			o		o
Shrub stratum.					
Banksia marginata	o	o		fa	
Acacia pycnantha			fa		
Casuarina sp.				fa	
Bursaria spinosa					o
Pultenaea daphnoides	fa	fa	o		fa
Leptospermum myrsinoides	fa	a	a	a	a
L. scoparium	fa	a		a	fa
Acacia myrtifolia	fa	fa	o		o
Xanthorrhoea semiplana	fa	fa	o		
Daviesia corymbosa	fa	fa			o
Ixodia achilleoides	fa	fa	fa		fa
Hakea rostrata	fa	fa	o	fa	o
H. ulicina	fa	o	o		o
H. rugosa				o	
Pultenaea acerosa, var. *acicularis*				o	
P. involucrata		fa	o		
Isopogon ceratophyllus				o	
Daviesia ulicina		o			
D. brevifolia	o				
Acacia verticillata	o	o			
A. vomeriformis			r		
Calythrix tetragona	fa		fa		
Epacris impressa	fa	fa	o		
Platylobium obtusangulum	o			o	
Grevillea lavandulacea	o				o
Pimelea spathulata	o				o
Hibbertia sericea		fa	a		a
H. stricta	fa	fa			o
Gahnia psittacorum		o			
Pimelea octophylla				o	
Melaleuca gibbosa				o	
Tetratheca pilosa		o			o
Persoonia juniperina ..	o	o			
Dillwynia hispida	fa				
Eutaxia microphylla	o				
Erechthites quadridentata ..	o				

Species	1	2	3	4	5
Undershrubs and Ground Flora.					
Bossiaea prostrata	o	o			
Viola Sieberiana	o				
Opercularia varia	o				
Halorrhagis tetragyna	o	o			
H. teucrioides			o		
Trachymene heterophylla	o	o			
Patersonia longiscapa	o	o			
Juncus pallidus	o				
J. bufonius	fa				
J. pauciflorus	o				
Lepidosperma semiteres	o	fa	o		fa
L. laterale	o				
Gnaphalium Japonicum	r				
Acrotriche serrulata	fa	fa	fa		o
Kennedya prostrata	o				
Goodenia primulacea	fa	o			
G. affinis	fa				
Scaevola microcarpa	fa	o			
Dianella revoluta	o		o		o
Lomandra dura	o	o	o		o
Astroloma humifusa	o		o		
Gompholobium minus		o			
Olearia Huegelii				fa	
Villarsia exaltata		o			
Burchardia umbellata	fa	o		o	
Themeda australis	o				
Dichopogon strictus	o				
Helichrysum scorpioides	fa				
Erythraea spicata	o				
Lobelia gibbosa	o				
Wahlenbergia gracilis	o				
Hypericum Japonicum	r				
Bartlingia sessiliflora	r				
Microtis porrifolia	o				
M. atrata				o	
Thelymitra pauciflora	o				
Helichrysum Baxteri				a	
Mitrasacme distylis				fa	
Parasite.					
Cassytha glabella	o	o			

VIII. ESSENTIAL OILS.

The essential oils of this species have been investigated by Baker and Smith (10) who state that "the average yield of oil was 0.62 per cent. The crude oil was light orange-brown in colour, with an odour indicative of an oil belonging to the cineol-pinene group, with a secondary odour suggestive of the aldehyde aromadendral. The presence of volatile aldehydes was particularly marked. The slight laevorotation of the crude oil is largely due to the aromadendral, although the pinene is also laevorotatory to a small extent. Phellandrene was absent. The left rotation is unusual with oils of this class, as in most cases the pinene shows a predominant dextrorotation. The cineol content is only fair, and the oil does not contain constituents having special characters. The species has, therefore, little value as an oil-producing tree. . . . . Chief constituents: pinene, cineol, aromadendral, sesquiterpines."

REFERENCES.

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2. Crit. Rev. Gen. Eucalyptus, Part XXI, 16 (1914).
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8. L.c. Part XXI., p. 17.
9. Trans. Roy. Soc. S.A., Vol. XL, 497 (1916).
10. L.c. 487.
11. Rep. Woods and Forest Dept., S.A. 1915, p. 4 and Fig. 3.
12. L.c. 1910, p.5.

EXCURSIONS.

EXCURSION TO HALLETT'S COVE, April 16, 1929:—Dr. Fenner led a large party to the historic "Tate's Rock," the scene of the first discovery of glacial markings in this locality. The leader gave a most interesting address on the Permo Carboniferous glaciation and its resultant markings on the rocks of Hallett's Cove, and dealt very fully with the changes of level in Tertiary times and the occurrence of fossils in the strata laid down. The party spent a most enjoyable afternoon.

EXCURSION TO MONTACUTE, April 25, 1929:—Owing to the threatening weather only a small number of members ventured to join the excursion. Under the leadership of Mr. W. Ham the party rambled up to the beginning of the Corkscrew Road and enjoyed the fine view of the hills scenery, from that point of vantage.

EXCURSION TO THE OUTER HARBOUR, May 4, 1929:—The Shell Club took charge of a well-attended outing, with Mr. W. J. Kimber as leader. The Outer Harbour is famous for the variety of its shells, and the party were successful in securing a number of species, which were named and described by the leader, who awarded prizes for the members obtaining the most rare species and the greater number of species respectively. A profitable afternoon was spent.

SOUTH AUSTRALIAN SHELL COLLECTORS' CLUB.

The fortnightly meetings of this Club have been regularly attended, and a large number of specimens were reviewed. A progressive study of Bivalve mollusca inhabiting our local waters has occupied most evenings since July, 1928, with further work remaining for future discussion.

FAMILY *VENERIDAE*.

The oblong shells of this family have generally solid, equally-shaped valves, with three divergent teeth, and an external ligament. Certain representatives are plentiful at the Outer Harbour, and collectors in this region soon discover that three can be grouped fairly closely together. The Club has provisionally decided to know these as—

Marcia corrugata—Lamarck.
Marcia scalarina—Lamarck.
Marcia aphrodinoides—Lamarck.

M. corrugata is elongate oval, attaining a length of 2½ inches, with blunt, well defined concentric ridges, running into each other, and crossed by radial striae, colour white.

M. scalarina, which is predominant at the Outer Harbour, has sharp, well-defined, regularly-spaced, continuous concentric ridges, with no radial striae, colour varies from white to violet. Juvenile examples show chevron markings.

M. aphrodinoides favour the mud flats that appear at low tide in front of the mangroves around the river; much more inflated than the previous specimens—the low concentric ridges barely rise above the shell's surface. No radial striae. The valves show little colour, except as juveniles, interior dark violet or black.

Marcia nitida is uncommon in this region, but is plentiful in the salt or brackish water at Onkaparinga mouth. This shell is somewhat inflated, and accuminate posteriorly. Colour brown, with broad rays.

The *Venerupidae,* unlike the *Marcia* (which revel in the soft muddy sands), favour a rougher environment, such as rock crevices, and hard mud banks, in which they burrow. The valves of some species are rough and shaped to suit their habitat, with sometimes overlapping valves. More or less frilled, and sometimes with crenated edges.

Venerupis diemenensis, Q. and G., is probably the commonest species in South Australia, and may be found in quantities among the shell debris cast up in such places as Middleton. A small, white specimen, with few concentric ridges, but with strong radial striations.

V. cumingii, Deshayes, lives in rock crevices along our coastline. The left valve is generally included in the right. The concentric ridges are closely spaced, with irregular radial striae.

V. exotica, Lamarck, is a handsome specimen, moderately rare, about 1¼ inches in length. The dorsal margin is almost straight. The valves are concentrically ribbed, with well marked radial striation, evenly distributed, also with distinct frilling. White with brown markings. Sometimes found embedded in sponges.

V. galactites, Lamarck, is common. Found living in the sand around seaweed roots, and similar environment. Its white valves are smooth, with very fine, closely spaced radial striations. Attains a length of 1¾ inches.

V. crenata, Lamarck, is a fairly large inflated shell of irregular growth. It is commonly found in nests or burrows formed in hard clay banks, such as exist at the mouth of the Onkaparinga River.

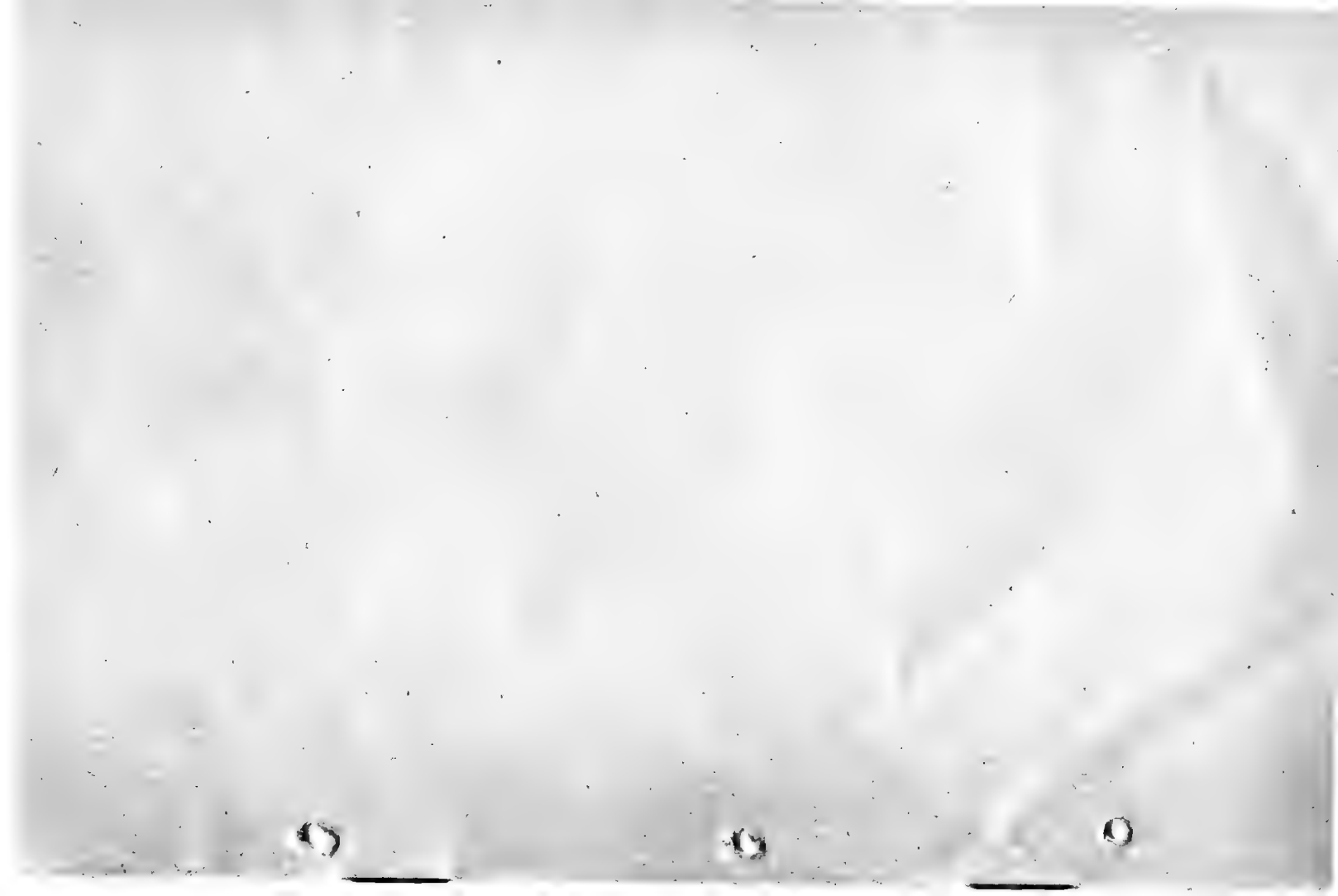
F. TRIGG,
Hon. Secretary,
April, 1929. S.A. Shell Club.

OUR EXCHANGES.

The Smithsonian Reports for 1927, including papers on the following subjects:—

"Soaring Flight."
"Palaeontology and Human Relations."
"Accomplishments of Modern Astronomy."
"Charles Doolittle Walcott."
"William Healey Dall."
"Friedrich Kurz, Artist-Explorer."
"Indian Villages of S.E. Alaska."
"Archaeology in China."
"The Origins of the Chinese Civilization."
"The Evidence Bearing on Man's Evolution."
"The Mind of an Insect."
"The Distribution of Fresh-Water Fishes."
"At the North Pole"
"Bird Branding in America."
"Recent Developments in Cosmical Physics."
"The Evolution of Twentieth Century Physics."
"Isaac Newton."
"The Centenary of Augustin Fresnel."
"The Nucleus of the Atom."
"The Coming of the New Coal Age."
"Is the Earth Growing Colder?"
"Geological Climates."
"Geologic Romance of the Finger Lakes."
"Fossil Marine Faunas as Indications of Climatic Conditions."
"Notes on the Principles and Process of X-ray Examination of Paintings."
"Lengthening of Human Life in Retrospect and Prospect."

"The Australian Forestry Journal," December and March numbers.
"The Queensland Naturalist," March Number.
"Papers and Proceedings of the Royal Society of Tasmania for 1928."



The South Australian Naturalist

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Mr. WM. HAM, F.R.E.S., Teachers' College, Adelaide.

EXCURSIONS.

Sept. 21—Burnside, Mr. A. A. Simpson's. Tram, 2 p.m. Foothills Flora. The President.

28—Blackwood, Mr. E. Ashby's. Train, 2.3 p.m. Cultivated Native Flora. Mr. E. H. Ising.

Oct. 9—Dashwood's Gully, Mr. J. A. Harper's. Charabanc, 9 a.m. Botany. Prof. J. B. Cleland.

10-11—FLOWER SHOW, TOWN HALL.

19—Bridgewater, Mr. F. C. Wollaston's. Train, 2.3 p.m. Cultivated Native Flora. The President

26—Semaphore (South). Train, 2.5 p.m. Shells, etc. Shell Club.

Nov. 2—Botanic Gardens. Entrance, 2.30 p.m. Australian Flora. Mr. J. F. Bailey.

16—Bridgewater. Train, 2.3 p.m. Botany. Mr. E. H. Ising.

30—Basket Range, Mr. W. Burdett's. Charabanc, 2 p.m. Cultivated Native Flora. Mr. W. Ham.

LECTURES AND EVENING MEETINGS.

*Sept. 17—"The Stellar Universe," by Prof. R. W. Chapman, C.M.G., M.A., B.C.E., F.R.A.S.

Oct. 15—Exhibit Evening.—Mr. A. M. Lea, F.E.S., "Some New Guinea Insects." 2. Mr. J. G. Wood, "Wallace's Line." 3. Mr. W. Ham, "Sea Urchins."

Nov. 19—Exhibit Evening.—1. Mr. E. A. S. Thomas, "Native Timbers." 2. Mr. E. H. Ising, "The Heath Family of Plants." 3. Mr. W. J. Hosking.

* These Lectures will be given with Lantern Slides in the Lecture Room.

The South Australian Naturalist.

VOL. X. AUGUST, 1929. No. 4.

GEOLOGY OF THE ENCOUNTER BAY DISTRICT.

By W. HOWCHIN, F.G.S.

(Emeritus Professor of Geology, University of Adelaide; author of "Geology of South Australia," "The Building of Australia," etc., etc.)

The Inman Valley is the type district in South Australia for the glacial phenomena of the Permo-Carboniferous age. The valley forms a part of an extinct glacial field of much greater extent, having its known limits from Victor Harbour in the south, to Hallett's Cove in the north, Kangaroo Island and Yorke Peninsula on the west, to the Murray flats on the east. The Inman and Hindmarsh Valleys were originally one and of pre-glacial origin. In consequence of the great depth of the original Inman Valley, which has been proved to have been at least 1500 feet, with ragged scarps on either side, the glacial features are of a unique kind, equalling, if not exceeding, the glacial remains of this age in any other part of the world.

The Inman Valley, which crosses the Fleurieu Peninsula almost from sea to sea, has an average width of five miles, and with the exception of its termini at the respective sea coasts, is almost enclosed by rocks of greater age. Those on the northern side form the elevated plateau of the Hindmarsh Tiers in a height of over 1200 feet above sea level. Towards the north-western side of the valley, the rocks are of a granitic type of the Pre-Cambrian age, while the rest belong to the Adelaide Series which rests unconformably on the former. A junction of the two series is well exposed at the Grey Spur, on Crossman's property, reached by the road that crosses the river a little to the westward of the 8 mile-post from Victor Harbour.

The snow-field that was the gathering ground of the great ice-sheets, lay to the southward of the present continent, where there is now deep water. This sunken land-mass was probably in the form of an upland plateau consisting mainly of granite and other igneous and metamorphic rocks that formed the core of a mountain range of which only the roots remain. In its passage northwards, the ice-sheet rounded off all the prominences in its way, scraped off the summits of Granite Island, Rosetta Head, West Island and King's Point, flooded the Inman Valley, and flowed over the adjoining heights.

The thickness of the ice-sheets is indicated by a bore put down in the Back Valley Creek, which after passing through glacial moraine material, struck bed-rock at a depth of 964 feet, proving that the ancient valley floor was at least at such a depth. The ice reached a level that covered the Inman Hill which is nearly 900 feet above sea-level, and Strangways Hill, which is still higher, so that the thickness of the ice could not be less than 1,500 feet. The floor over which the ice moved consisted of a very hard siliceous quartzite, which has been deeply grooved, scratched and polished, under the grinding action of the glacier. In every instance where the floor and sides of the valley have been recently exposed, these effects can be seen.

Some very fine ice-smoothed hummocks (*roches moutonnee*) can be seen near the residence of the late Mr. D. H. Cudmore, at the beginning of the Hindmarsh Valley, also the conspicuously isolated Crozier's Hill, on the north side of the main road, soon after entering the valley. This hill is a beautiful illustration of ice-action on a gradual slope, ploughed by the ice on its advancing side, and "plucked" in a broken face on the lee.

The lower reaches of the Inman are choked with moraine sand transported by the river, but higher up, numerous examples of the glaciated rock floor can be seen in the bed and sides of the stream. At the road crossing the river, already referred to, a fine exposure can be seen at an acute bend of the stream. This is, undoubtedly, the ice-polished rock seen by Selwyn in 1859, the first example of a glaciated rock recognised in Australia.

The erratics are a remarkable feature throughout the valley, both for numbers and great size. They form an interesting group in the shallow water at Encounter Bay, including one on the shore that is 23 feet in length. They show in great number in the moraine trail from Rosetta Head to Glastonbury Hill at the entrance to the Inman Valley. They are particularly numerous along the northern side of the valley where the ice ploughed into and over the scarps of the Hindmarsh Tiers, and can be

traced over the watershed of the Bald Hills into the valley on the other side. The moraines of Mount Brecken, near Victor Harbour, and King's Point facing West Island, with their large erratics showing in the till, are as typical as could be seen anywhere.

It is remarkable that in these low latitudes there should be remains of two of the most intense Ice Ages that the world can show. Although separated by many millions of years, the newer (Inmanian) tillite rests directly on the older (Sturtian) tillite which it has ploughed up and carried forward in large masses as erratics—a unique feature nowhere else seen in the world.

The ice having travelled over a region largely composed of granite rocks, the moraine material transported by the glacier consisted largely of triturated quartz and other crystalline minerals. Where a granite subsoil has been long exposed to the chemical action of atmospheric gases and surface organisms it passes up into a fairly productive light soil, but if the surface soil consists of fresh and little altered crystalline fragments it is particularly sterile. The moraine material, as laid down, was freshly ploughed up from the unaltered rock and laid down in great thickness, and for ages has been protected from atmospheric influences and without contact with vegetable and other organic material, so that in its natural condition it is partly supplied with plant food. The valley that was once choked to the brim with this material is now being slowly re-excavated by rain and river, and in exposed situations the soil gets little chance of enrichment. This is seen in the sandy hillocks and comparatively bare slopes so characteristic of the district. The preponderance of quartz sand leaves the soil open to a full circulation of water and, thereby, becomes leached of organic and soluble ingredients, leaving the soil poor. Where the soil is in contact with older and more diversified rocks, the weathering of the latter feeds the soil which gathers richness from the blend. So, again, the rivers and creek flats subject to floods, are similarly enriched and made productive. The lower members of the moraine are of a more argillaceous kind and form a stiff soil characteristic of a typical "till," which when mixed with the overlying sandy material makes a good soil, while the clay in its natural condition, by its retentive qualities, causes swamps in places. These contrasted conditions of habitat have led to local segregations in the flora and the formation of plant communities clearly referable to the kind of soil in which they grow.

EUCALYPTUS.

THE ESSENCE OF AUSTRALIA.

The eucalypts of Australia are generally regarded as forming about three-quarters of the vegetation of our Continent, says the Economic Chemist of the Technical Museum, Sydney, Mr. A. R. Penfold, F.A.C.I., F.C.S., in an article in the June Number of "The Australian Forestry Journal," from which the following article is extracted. The writer goes on to say that, though known as "gum-trees" they give out no gum, the exudation being in the nature of an astringent tannin, properly termed "kino." Endemic only to the mainland and Tasmania, and not occurring naturally even as far afield as New Zealand, they are grown in millions in New Zealand, South America, South Africa, India, and especially in California, U.S.A. One of the first natural products exported from Australia was eucalyptus oil. This was in 1798.

The name "eucalyptus" is derived from the two Greek words, "eu" meaning "well," and "kalypto" meaning "I cover," the reference being to the lid (operculum) which seals the flower until it is thrown off during the process of opening, and it is this characteristic feature which distinguishes the genus eucalyptus. There are over 300 species known, 180 species have been examined for essential oils, but only 20 yield oils of commercial value. Of these *Eucalyptus cneorifolia* (the narrow leaf mallee of Kangaroo Island is one of the best). It is said that 1,000 lbs. of leaves yield about 20 lbs. of oil, containing nearly 60 per cent. of cineol or eucalyptol, the principal constituent of the medicinal oils. Industrial oils used in the flotation processes for the separation of minerals contain another constituent, phellandren. These industrial oils also find an extensive use in the preparation of disinfectants, boot polishes, etc. Other eucalypts yield oils largely used in perfumery. From *Eu. citriodora,* of which there are some specimens growing in our Botanic Gardens, citronella and rose oils are produced.

A recent development is the production of very effective disinfectants possessing very pronounced germicidal properties as well as a more pleasant odour. Thymol, a very powerful antiseptic, and Menthol are being produced from various eucalyptus oils. Menthol is used in pharmacy, and very extensively in confectionery.

THE TREES OF THE ADELAIDE STREETS.

—:o:—

Our readers may be interested to read the following extracts from a report by the City Gardener, Mr. A. W. Pelzer, F.R.H.S.

STREET PLANTING.

In considering the trees growing in the City streets it is to be remembered that they are growing under unnatural conditions. To assist them they are specially prepared when in the nursery by being frequently pruned in order to induce the growth of fibrous roots, so that they may be the better able to withstand drought and similar unfavourable conditions.

As the result of experience it has been found that the following trees are the most suitable for planting in City streets:—

English Ash Tree (*Fraxinus*); Nettle Tree (*Celtis*); Plane Tree *(Platanus)*; Honey Locust Tree *(Gladitschia)*; and Varnish Tree (*Kolreuteria*).

Of the foregoing, the three first named have the advantage of a very long leaf period. The English Ash is an excellent tree in this respect, as it is in leaf more or less during some nine months out of the twelve. The Pagoda (*Sophora*) and Nettle *(Celtis)* trees also have long leaf periods, that of the remaining three being somewhat shorter.

The White Cedar (*Melia*) in some respects is suited to street planting, but the berries which fall from it are an objection as they are a source of danger on paved walks.

The *Robinia inermis*, with the globe shaped crown, which may be seen growing in the playgrounds, would be a suitable tree for planting in narrow streets but for its unfortunate tendency to send up suckers. The six kinds which I have referred to as suitable for street work have not this tendency.

PLANTING IN PARKS AND GARDENS, AND RESERVES.

The following trees have proved themselves adapted to local conditions:—

DECIDUOUS.—In addition to those already mentioned for street planting, the Elm Tree (*Ulmus*), Tree of Heaven (*Ailanthus)*, Acacia Tree *(Robinia)*, and White Poplar Tree *(Populus)*, give satisfactory results in park lands.

Of the ever-greens, the Carob Tree (*Ceratonia*), Jacaranda Tree (*Jacaranda*), Camphor Tree (*Camphora*), Kurrajong Tree (*Sterculia*), Flame Tree (*Brachychiton*), Coral Tree (*Erythrina*), Moreton Bay-fig Trees, both large and small leaf, have proved to be well adapted to local conditions; of Sheoak Trees, the species *Casuarina glauca* succeeds well on limestone and brackish soils. The Conifers are of value from an ornamental standpoint for planting in round spaces, particularly in view of their symmetrical form, and the following species have been found to do well on the park lands:—

Norfolk Island Pine, Austrian Pine, Stone Pine, Aleppo Pine, Canary Island Pine, Cedrus, and Cypress. The species Cedrus also grows well on selected sites.

Of gum trees the Lemon scented gum (*E. citriodora*) when planted in good deep soil, the Yate gum (*E. cornuta*), Sugar gum (*E. cladocalyx*), and Tuart gum (*Eucalyptus gomphocephala*) all grow well in suitable localities on the Adelaide Plains. The Scarlet flowering gum can be grown successfully, but only in certain localities. The same applies to the Red gum (*E. rostrata*), which requires a deep rich soil, while the Tuart gum, which is a very hardy species, will grow on limestone soil.

Regarding the Fig Tree (*Ficus nitida*) growing in the grounds at the Terminus Hotel, North Terrace, and the evergreen Oak (*Quercus Ilex*) in Government House Domain, specimens of both these trees may be seen growing in the City gardens, the former in Elder Garden, Victoria Square, and the West Park Lands, and the Evergreen Oak in Osmond, Angas, and East Terrace Gardens, both species are hardy and give very good results.

The Flame Tree is thriving well in Whitmore, Wellington and Victoria Squares, Osmond and North Terrace Gardens.

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FIRST PUBLICATION BY THE F.N.S.

"The Flora of Encounter Bay," by Professor Cleland, which has been published serially in the *S.A. Naturalist*, is to be issued by the Section. In addition to the articles by Professor Cleland, there will be an account of the geology of the district near Victor Harbour, written by Professor Howchin, and illustrated with plates. The pamphlet will be on sale shortly.

REVIEW: FLORA OF SOUTH AUSTRALIA, PART IV.

Bignoniaceae-Compositae.

J. M. BLACK, Lecturer in Botany at the University of Adelaide. 1929.

This is the concluding part of the flora, and Mr. Black is to be heartily congratulated on its successful completion. The Flora has been eight years in preparation and must have entailed an enormous amount of work in the examination of specimens and in locating some of the types. A large number of new species and varieties and new combinations have been created by Mr. Black, and excellent descriptions have been drawn up for each. The task of delving into the extensive botanical literature and deciding which was the earliest name given to our plants places Mr. Black as the leading authority in Australia on Australian botanical nomenclature. To show what difficulties the systematic botanist meets reference may be made to *Melothria micrantha* (p. 543). This plant was first named by Mueller in 1855 as *Cucurbita micrantha*, in 1859 Naudin created the name *Cucumis Muelleri* for it and Bentham referred to it as *Melothria Muelleri*. Three genera are thus used in which to place this species and the author had to decide which was the correct one (as each has definite limits) and deciding on the latter one the specific name to accompany it must be that first used no matter what generic name was attached to it. A similar procedure had to be adopted with *Rutidosis multiflora* (see p. 639). The completed work contains almost 700 pages of plant descriptions, with indexes of scientific and popular names, so that the Flora is of practical use not only to the botanist but to gardeners, students and others as well. Following the custom in all recent floras the weeds and foreign introduced plants are delineated, and exceptionally large numbers of drawings of these are given. Gardeners, orchardists, nurserymen, etc., should find the book valuable on this account. Not every plant has been given a popular name, but where one has become established through general use it has been given. This part is well illustrated, and the keys to the genera and species are most helpful.

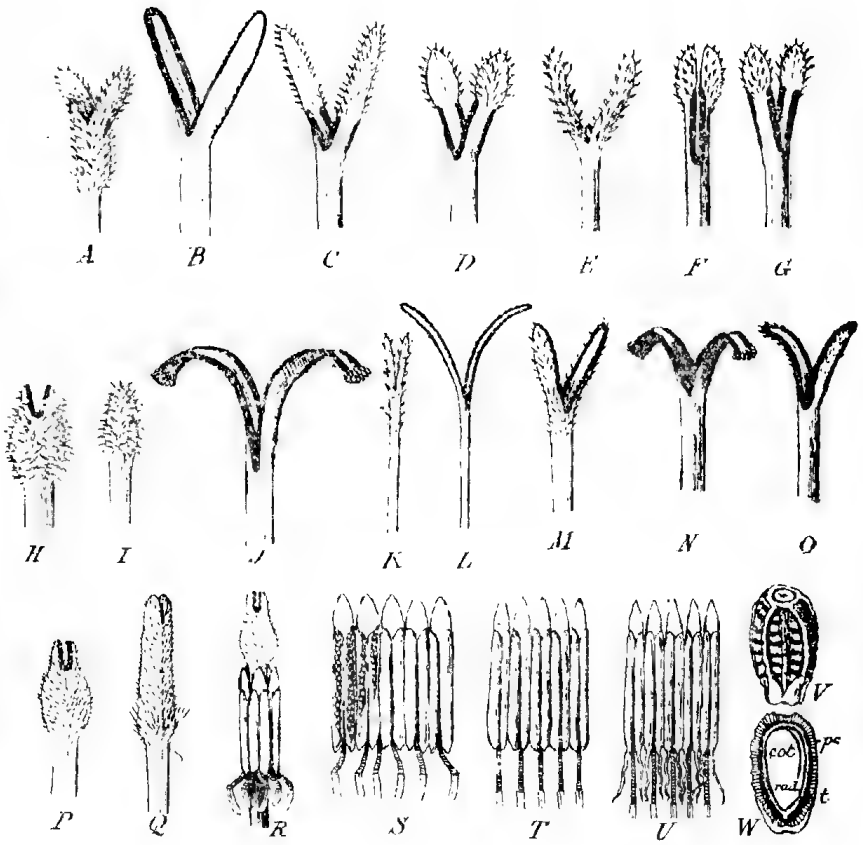
Plates Nos. 4 and 5 are reproduced here as samples of the illustrations used, and the whole of the 54 plates and the 338 figures were drawn by the author himself. The value and practical use of the Flora is wonderfully enhanced by these, and they reveal Mr. Black as an artist of extremely high attainments. The practice of illustrating the generic differences in the families has again been utilised in this part, and they immediately follow the description of the family itself.

Eremophila neglecta, J. M. Black.
(Block lent by courtesy of Royal Society of S.A.)

Plate 4.

From "The Flora of South Australia." Part IV.
J. M. Black.

Plate 5.



Compositae. Upper part of styles (all much enlarged).

(Block kindly lent by courtesy of Government Printer.)

From "The Flora of South Australia." Part IV.
J. M. Black.

The treatment of *Eremophila* in Myoporaceae is satisfactory as it is better to place all the species under that genus, where they have been for so long, than to place some under *Pholidia* and others under *Stenochilus*; a certain amount of confusion is thus obviated. Mr. Black has created four new species in this genus.

In the family Campanulaceae *Pratia* has been separated from *Lobelia* to fall into line with the great majority of botanists. In Goodeniaceae the species of *Goodenia* are accompanied by excellent descriptions and *G. geniculata* has now been satisfactorily divided into several distinct species, viz., *G. primulacea, G. affinis* and *G. robusta*.

The extensive and somewhat difficult order Compositae has been thoroughly revised and well illustrated. Drawings of the most difficult parts of the flower to examine, the style and anthers, have been given in many of the genera. The excellent keys to the tribes and genera, as well as a fine series of drawings, will be of great assistance to the systematic botanist. *Brachycome* is well illustrated by drawings of ripe fruits, and five species are named by the author. *Calotis* is illustrated in a similar manner, as in the former, the remarkable barbed awns or pappus of this genus is well shown. Twenty-seven species of *Olearia* have been listed and have been transferred from *Aster*, which is not considered an Australian genus. The everlastings (27 in *Helipterum* and 23 in *Helichrysum*) form a large section, of which Mr. Black has described a number of new species. Quite a number of alterations in the names of various species had to be made in this family, and among the introduced genera illustrations are more numerous. Through recent work of specialists in England on the grasses, Mr. Black has added eleven pages of new arrangements and notes in this family. Altogether 34 pages of additions and corrections have been added, the Flora now comprises 2,430 species of which 2,064 are indigenous, and 730 genera of which 580 genera are native plants. A map of the State, showing railways, rivers and the principal towns, concludes the work.

———:o:——— E.H.I.

FLINDERS CHASE:
Kangaroo Island.

Dr. J. B. Cleland and Mr. J. F. Bailey (members of the Fauna and Flora Board), reporting to the Chairman (Dr. E. Angas Johnson) on an official visit to Flinders Chase, Kangaroo Island, say that kangaroos and wallabies seem to be flourishing in the enclosure, and are abundant outside. A native bear was seen some months ago. Cape Barren geese and emus seem to be doing well. The visitors saw where the platypuses had been liberated, but failed to locate them.

EXCURSION TO WATERFALL GULLY.

May 18, 1929.

A party of field naturalists visited Waterfall Gully to study gorge flora, under the guidance of the Secretary (Mr. E. H. Ising). During the walk from the terminus of the Burnside tram, Mr. W. Ham drew attention to the geological features of the narrow ravine, pointing out the bedding planes, the joint planes, the dip and the contortions of the strata, the uplift or sinking of the layers, faults and the character of the rocks. He also explained how the fall had regressed up the valley as the softer rock decayed and was carried down by the stream and new faces were exposed to the action of weather and running water. In the upper reaches the rocky faces were precipitous and a cross section would show a V-shaped cleft, due to the grinding action of fragments carried by the rapid waters, but lower down the gentle lapping of the water had rounded the banks into a wide trough, which finally subsided into the plain.

The road was lined with English hawthorn, and in one place appeared the native raspberry *(Rubus parvifolius)*. Weeping willows (*Salix babylonica*), were much in evidence, and a garden of magnificent chrysanthemums was admired. A feature that caused some comment was the diversity of vegetation on the slopes and on the ridge. While tall gums were conspicuous on the heights, the rounded sides of the gorge were clad with sheoak (*Casuarina*). On the eastern slopes banksia and eucalypts flourished. Between the first and second falls a species of wattle (*Acacia rhetinodes*), known as "bald" or "*Warilda*," was beginning to put forth its blossoms. The woolly tea-tree (*Leptospermum*) was also observed. The stringybark, with its rugged covering, was growing here at an elevation of about 800 feet or less, though seldom seen at a lower level than 1,300 feet. This tree, named by l'Heutier, a French botanist (*Eucalyptus obliqua*), from its unsymmetrical leaves, was first observed on Captain Cook's voyage. The peculiarities of the gorge flora are due to the abundance of moisture and the shelter of the steep-sided gully.

Other plants observed included *Solanum*, of the same family as the deadly night-shade, *Siegesbeckia*, and *Leptospermum pubescens*, with grayish leaves and downy seedpods; the Australian "blue bell," which flowers all over the State; the coarse kangaroo grass, a valuable fodder that in early days extended over the greater part of South Australia, and still flourishes along the hills railway line, where the ground has been undisturbed, also *Lepidosperma* (scaly seed), a species of sedge.

EXCURSION TO WARPOO.
June 3, 1929.

On the holiday Mr. Suttton, ornithologist of the Museum, conducted a party over the scrub near Warpoo, between Lyndoch and Sandy Creek, where they examined the rich and varied bird life of that picturesque locality. An enjoyable and profitable time was spent, and 25 different species were observed.

VISIT TO THE MUSEUM.
June 15, 1929.

A large party spent some pleasant hours at the Museum, under the guidance of Mr. H. M. Hale, the assistant director, and his colleagues, Messrs. A. M. Lea and N. B. Tindale. Near the entrance Mr. Hale called attention to some coils of "Feather Money," from Mexico and Santa Cruz, in beautiful colours, and valued at £80. A mummified baby from the River Murray was pointed out. "Ginseng," a plant highly esteemed by the Chinese for its medicinal properties, was represented by some dried specimens. A substance believed to be ambergris, with the characteristic black nodules, might be worth anything from £4 an ounce. The witch plant mentioned in Genesis, "mandrake" (so named from its quaint resemblance to a human embryo) is used as a base for various perfumes. Mr. H. M. Hale next illustrated from a number of specimens the evolution of the backbone from the first rudiments of a notochord. Mr. A. M. Lea, the Museum Entomologist, showed a very varied and comprehensive collection of insects, both Australian and foreign.

EXCURSION TO MORIALTA.
June 29, 1929.

A party of field naturalists proceeded to Morialta on a botanical excursion, conducted by Dr. J. B. Cleland. The introduced plants, including sugar gums *(E. cladocalyx)*, *Acacia Baileyana*, *A. podalyrifolia*, and many others were making great headway, the latter species of wattle being in full bloom. Differing species of vegetation marked varying heights and situations. Down near the running stream the stately forms of the red gum (*E. rostrata*) were conspicuous (the specific term is an allusion to the seed capsules, shaped like a beak or rostrum). These fine trees usually favour a moist situation, and often outline the course of a creek. Higher up the so-called blue gum (or yellow gum), *E. leucoxylon*, lifted up his leafy crown with *E. odorata* (peppermint) intermingled. *E. fasciculosa* (with its seed pods in bundles

or fasces), and *E. viminalis* (manna gum, with short, conical seed pods), were also observed. *Leptospermum lanigerum* (woolly tea-tree) grew on the bank lining the road. Among wattles of indigenous growth, *Acacia rhetinodes* and *A. continua* flourished, but not yet in flower; also *A. rupicola*. Towards the summit the gentle breeze sighed among the cones and branches of the *Casuarina stricta* (sheaoak). Two species of *Xanthorrhoea*, or grass tree or yacca, *X. quadrangulata* and *X. semiplana*, were noted. The wild hop, *Dodonaea viscosa*, had grown into a large shrub. A plant rarely found in the foothills, *Halorrhagis Brownii*, rewarded the researchers of the party. The *Spyridium* has small whitish floral leaves, which resemble the petals of a flower. *Anthocercis* (ray flower) has a white wheel-shaped corolla, the lobes giving it the generic name, and the narrow leaves give the specific description *(angustifolia)*. The wild cotton bush is an importation from America, and was accompanied by a peculiar species of moth. *Imperata cylindrica* was once considered capable of producing paper pulp. *Banksia marginata* grew at a low elevation. A bearded grass, *Andropogon* (manly beard) is common in the foothills. *Correa rubra* (popularly known as native fuchsia) and *Hardenbergia* or wild lilac, were in flower. Among orchids were observed the dainty greenhood, *Pterostylis*, with *Glossodia* and *Acianthus*. The scarlet runner *(Kennedya prostrata)* was not yet decked with its bright red blossoms. Another remarkable plant is the flame heath *(Astroloma conostephioides)*. Many other species of native plants were observed.

The party greatly admired the striking regularity of the huge layers of Cyclopean masonry that bound the valley near the first fall, and the sparkling grace of the aptly-named bridal veil waterfall. An account of this romantic glen would not be complete without some slight tribute to the engineering skill and good taste with which the steep and winding paths and the rustic bridges and hillside chalets have been constructed, so as to harmonise with the picturesque surroundings, and consult the convenience of visitors without being unduly obtruded on the view.

EXCURSION TO SEMAPHORE.

July 13, 1929.

Field Naturalists, led by Mr. W. J. Kimber, explored the beach north of the Semaphore Jetty. Some strange zig-zag, well-defined tracks were noticed near the water. On following these up the party discovered a remarkable mollusc, known to science as a *Pollinices conica*. These ingenious creatures very cleverly con-

struct worm-shaped tubes of minute grains of sand, in which the female deposits thousands of eggs. Several specimens of *Haliotis* lid or cover, which closes the mouth of the valves, also affords evidence of wonderful adaptation. Several specimens of *Haliotis cyclobates*, or mutton fish, were found. These molluscs were a favourite dish with the aborigines, and the sites of their camps, especially in Tasmania, are marked by great heaps of the empty shells. Both the interior and exterior are nacreous. The *Sigaretus zonalis* has a large foot, so large that it cannot, like some other gasteropods, withdraw wholly into its shell, which covers only the vital parts. *Nerita melanotragus* is an edible mollusc known as the black winkle, and is a palatable morsel. Its operculum, or lid, is worth observation. *Bankivia* is a small mollusc usually found in populous communities on beaches such as the Outer Harbour. Their remains form peculiar pink ridges. *Mactra pura*, the largest S.A. mactra species is a beautiful white shell, and is prized by anglers for bait. *M. Australis*, a smaller blue variety, is good food. A so-called gastropod, the *Vermetus*, is a worm-like mollusc, which does not move about on a "stomach foot," but attaches itself to other shells or rocks. A tube-building worm had left some of its handiwork on the beach in the shape of a tube about two inches long, constructed of microscopic sand grains, cemented by a sticky secretion. Through an ordinary magnifying glass the glittering grains could be clearly seen. *Siliquaria australis* has a strange slit through its entire length, serving the purposes of respiration and excretion. *Thalotia conica* is a very pretty brown shell, belonging to the trochidae, or top shells, all noted for their beauty. Another of the same family is *Phasianotrochus bellulus*, possessing also brilliant colouring and exquisite markings. An *Avicula* or butterfly shell, is the only representative in South Australia of the pearl shell mollusc. The *Murex* is a relative of the shell from which the ancients obtained the famous "Tyrian purple." The *Solemya australis*, peculiar to the continent, has a remarkable periostracum, or covering, not wholly composed of carbonate of lime. An interesting find was a cluster of egg capsules of *Sepia apama*, a decapod, or ten-footed cephalopod, commonly known as the cuttlefish. This creature is a favourite food of the predatory sharks, and for that reason would soon be exterminated but for its marvellous fertility, a striking instance of how a persecuted organism (plant as well as animal) manages to survive and propagate its kind by the abundance of its offspring, although millions die.

Mr. Harding showed a perfect specimen of a large sponge formation, usually called from its shape "Neptune's cup." This consists of the skeletons of countless numbers of polyps, which

live together in common. These polyps are lined with cilia, or fine hairs, whose constant oscillation sets up a current in the water. With tiny inhalant syphons they bring food to the community and eject the indigestible matter with another set, the exhalant syphons.

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SOUTH AUSTRALIAN SHELL COLLECTORS' CLUB.

The following members would like to arrange exchange of local shells with foreign correspondents:—

Mr. F. L. Saunders, Arthur Street, Unley.
Miss Kentish, Riverside School, Fitzroy.
Mr. Harding, c/o Barlow's, Port Adelaide.
Miss Wayne, Port Road, Hindmarsh.
Mrs. Pearce, Capper Street, Kent Town.
Miss Roeger, Gaza.
Miss V. Taylor, 95 Grenfell Street, Adelaide.
Mr. Godfrey, Robert Street, South Payneham.
Mr. Broadbent, Epworth Building, Pirie Street, Adelaide.
Rev. H. Gunter, Paynecham.

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LECTURE.

"OXFORD UNIVERSITY TRIP TO SPITZBERGEN."

May 21, 1929.

By Mr. R. W. SEGNIT, B.Sc.

The lecture was illustrated by lantern slides, depicting the configuration of the lands visited and their fauna and flora.

Mr. Segnit gave a general outline of the geographical position of the Spitzbergen Islands and their relation to the mainland of Europe, the track followed by the warm Gulf Stream from the equator to the Arctic, its influence on the temperature and climate of Spitzbergn, and a brief summary of the history and scientific results of previous expeditions. The composition and objects of the expedition were dealt with, and a description was given of the journey north, which was started in 1921, and included a forced stay of ten days on Bear Island, situated approximately 200 miles from Spitzbergen. The lecturer dealt with Spitzbergen topography, giving an explanation of its geological features, its tectonic uplifts, fjords, glaciers, and the various stages in the general retreat of the ice. The expedition had been particularly educative from a botanical standpoint, there being no less than 196 species of mosses and 68 species of lichen existing in the islands. The flora included a great number of Arctic species. Sixty-five species of birds were known to inhabit Spitzbergen, and interesting results to the zoologist in the study of mating, nesting, and breeding habits of some of the birds, particularly the red-throated diver and purple sandpiper, had been obtained.

WILD FLOWER SHOW.

The Show will be held in the Town Hall as usual on October 10th and 11th. Members are asked to make preparations and to bring such natural history exhibits, etc., as they can secure, and are invited to help in the work of preparation on the Thursday evening, October 10th.

The prizes for painting are arranged as follows:

A—For Central Schools only:

(1) Water Colour Painting; prizes of 7/6 and 5/-.

(2) Art Designs; prizes of 7/6 and 5/-.

B—Open to all Amateurs:

Prizes for Water Colour paintings only; 10/6 and 5/-.

The subjects are to be native flowers or designs based upon native flowers, etc.

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OUR EXCHANGES.

1. "The Australian Naturalist." March, 1929.
2. "The Victorian Naturalist." May and June, 1929.
   "Notes on Certain Species of Thelymitra," by W. H. Nicholls, is an interesting discussion of the various species of this beautiful family of orchids.
3. "Journal of the Royal Society of Western Australia." Vol. XIV. 1927-1928.
4. "Journal of the Arnold Arboretum of Havard." January and April Numbers.
5. "The South Australian Ornithologist." July, 1929.
6. "Annals of the Polish Zoological Museum."
7. "The John Crerar Library Annual Report for the Year 1928."
8. "Sturt Centenary, 1829-1929." Issued by the Dept. of Lands and Survey.

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ADDITIONS TO OUR LIBRARY.

1. "The Australian Forestry Journal." June, 1929.